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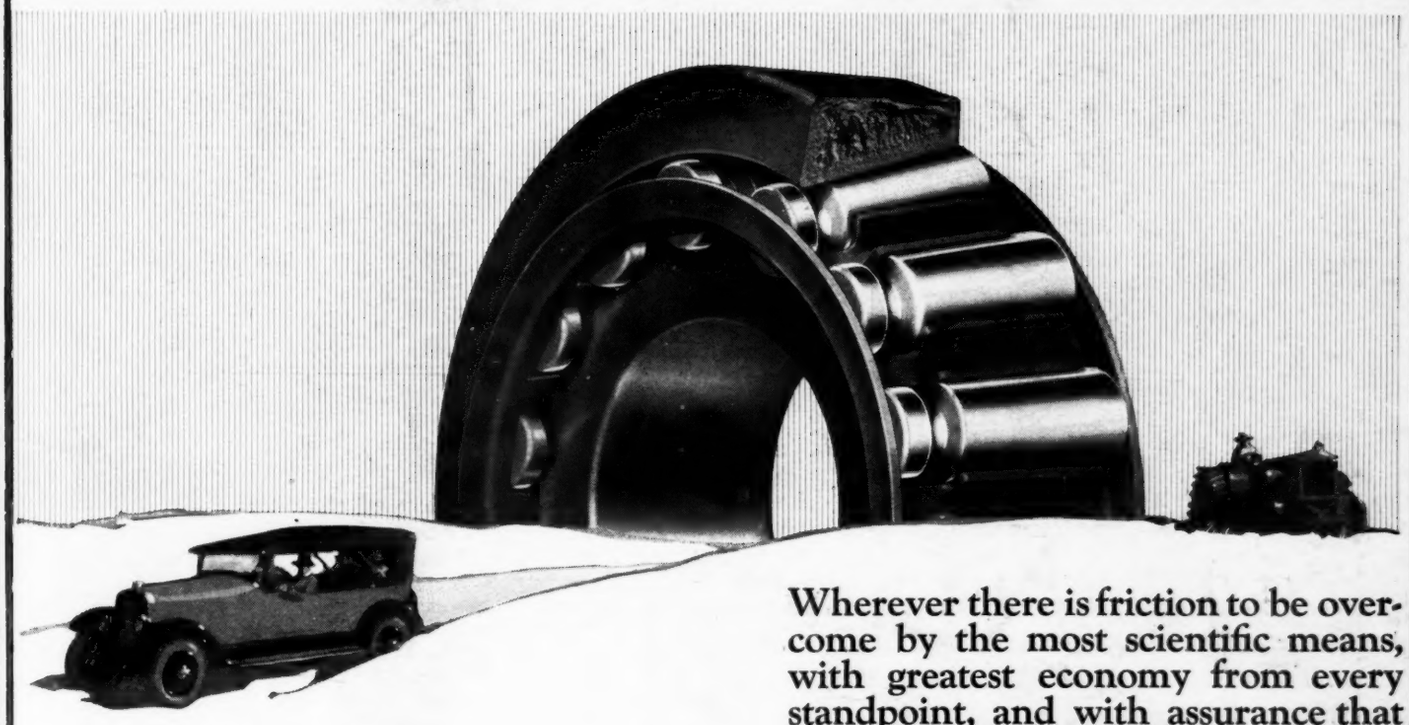

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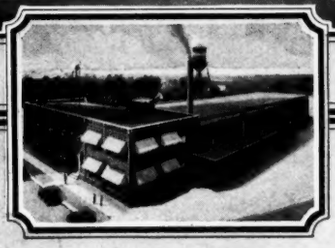

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AUTOMOTIVE INDUSTRIES
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VOL. XLVI. NEW YORK—THURSDAY, APRIL 6, 1922. No. 14

Production Program or Quotas —Which Comes First?

Description of methods employed by manufacturers to establish quotas. In current practice quotas are adjusted to a predetermined production figure. Analysis shows inherent weakness of this method and proper approach for solution of the problem.

By Norman G. Shidle

THE annual production of each passenger car manufacturer is distributed to branches or distributors and by each branch or distributor to the various dealers within the given territory. There must be some basis for allotting cars to these distributors or branches, some method of determining how many cars shall go to each. The simplest method would be to divide the total proposed production by the number of distributors. This would give an equal number of cars to each one. The vital objections to such procedure are obvious. It becomes necessary then to determine the best possible method of making these allotments, the best possible method being that which enables the manufacturer to achieve the most efficient and least costly production and distribution.

The practical value of an accurately established quota is not sufficiently recognized in the industry at present. The methods used for establishing quota in many cases grew up out of the necessities of heavy demand during peak production times. Distributors and dealers were clamoring for cars. It was difficult to "stall them off." So certain specific quotas were laid down on one basis or another chiefly to give the sales manager some sort of reason to refuse more cars when necessary.

The fundamental reason for establishing quotas in any manufacturing business, however, is to determine as accurately as possible the probable market for the product during the given year or production period. A properly established quota will aid in the determination of the production schedule. Consequently it cannot be dependent upon a previously determined production schedule. To be of maximum value a quota should be so established that it will show with some accuracy the probable market in a given territory for the given car.

The term quota is sometimes used to mean different things. It may be built up to determine:

1. Maximum possible sales.
2. Minimum satisfactory sales.
3. Probable sales.

For the purpose of this discussion the first definition will be utilized, because it is fundamental. From it can readily be derived either of the other two, provided they are more desirable for practical use.

Uses of Quota

Too frequently the possible uses of a properly established quota are not recognized. Usually, passenger car quotas serve no purpose other than that of fur-

nishing some basis upon which to distribute a predetermined production of cars. Sometimes the quota is used to check up distributor performance to a certain extent. Quotas as now established in most cases, however, do not constitute proper standards by which to gage sales performance.

The scientifically established quota, however, has a practical financial and economy value. It can aid in determining what shall be the production for the year, which will in turn enable the manufacturer to take advantage of long range buying, to stabilize his labor force, to facilitate financial plans and to increase production and marketing stability all along the line.

It can be used, moreover, as a proper standard of performance for distributors and dealers, enabling the manufacturer to check with some real degree of accuracy the excellence or lack of ability of his distributor organization.

Before proceeding to a discussion of how such an accurate quota may be built up, it is worth while to survey the methods now in use. Nearly every plant has a different method of procedure.

In one factory quotas are established by taking the actual number of cars sold by a given distributor last year and adding to that number "as many more as the factory thinks he can handle in view of his selling ability and conditions within his territory." The number of cars to be produced by the factory, however, is determined before these quotas are established, so that the sum of the distributor's quota must arbitrarily be brought to that predetermined production total.

In another case, the distributor is expected to take a number of cars equal to a given percentage of sales of competitive makes to the total sales of the competitive group in his territory during the preceding year.

Another factory practically allows the distributor to say how many cars he will take.

Still another bases its quotas upon the number of cars taken last year by the given distributor, plus a certain number which is determined in conference with the distributor.

One company sets its production schedule and then gives to each distributor a proportion of that predetermined number based on the percentage of production absorbed by that distributor during the previous year.

One successful manufacturer likewise bases quota on the percentage of past production taken by the given distributor. Production is based upon "a number of factors compiled by the statistical department."

Another company relies very largely upon the intimate personal knowledge of the field possessed by a capable sales manager, correlated with the past performance of the distributor and the opinion of the district sales manager.

Still another method is found in basing quota upon the percentage of the given make of cars sold in the territory as related to total sales during the previous year plus a certain per cent.

A few companies use more detailed methods. One successful, conservative organization, for example, establishes distributor quota in this way: The percentage of registrations in a given territory to the total car registrations is first determined. The factory then determines the percentage of its own production absorbed by that territory during the previous year. When these percentages are about the same, as they are in many cases, the distributor is allotted that percentage of the year's production. When the two percentages do not agree, however, a compromise percentage is given, arbitrarily fixed with due regard to conditions within the territory, the number of cars that the distributor himself believes he can sell, road conditions and other factors.

Very elaborate market analysis work precedes the establishing of quota in one or two cases. Comprehensive and accurate data are collected concerning a large number of factors affecting sales possibilities. These data are listed, a certain weight is given to each of the factors and the factors are correlated to give the quota for the given territory.

Evaluating Present Methods

Brief analysis will show that in every case, except the last mentioned, the basis used in establishing the quota makes the quota useless so far as concerns its being an aid in determining the most economic production schedule or in acting as a standard of distributor sales performance.

This is true because the quotas are established on the basis of a predetermined production schedule, which in turn has not been based upon any very comprehensive market analysis; or they are based upon past performance as related to the given company itself. The basis of establishing quota is *relative* in almost every case, rather than *absolute*. It is not useful as a standard of performance for this reason.

In most cases only a few of the factors affecting sales are utilized in establishing the quota, which consequently becomes a necessary tool rather than a useful standard.

This condition is natural at the present stage of the automobile industry. The industry is comparatively young as a whole, while the necessity for a study of marketing problems is less than two years old. The industry has arrived at a point, however, where procedure must be based upon more fundamental factors.

Methods of Establishing Quota

In establishing accurate quota, which can be of maximum use, the problem should be approached from two angles:

1. Past performances.
2. Market analysis.

As explained in previous articles in AUTOMOTIVE INDUSTRIES, the slowness with which buying habits and human nature change makes it possible to determine with a high degree of accuracy probable trends for a year or two in advance on the basis of past performance, provided data concerning that past performance are available over a long period of time. A complete discussion of this phase of the subject is contained in AUTOMOTIVE INDUSTRIES of Nov. 17, 1921.

Thus the probable production of cars in a given price class for the coming year can be determined with a high degree of accuracy by a proper correlation of past statistics. Statistics showing the probable production by price classes for 1922 appear in the Statistical Number of AUTOMOTIVE INDUSTRIES, published Feb. 16, 1922.

In our issue of March 23 we showed how the individual company can compare its growth with that of its price class, and how it can determine its probable production for the coming year on the basis of past performance. It is unnecessary to cover these phases in detail here, but a thorough understanding of this previous material is essential to a proper reasoning through of the entire problem.

We may assume then that the Sennett company, for example, has determined its probable sales possibilities for 1922 on the basis outlined above. The figure so determined will be very nearly correct, because varying conditions throughout the country, whether favorable or unfavorable in various sections, will probably balance one another. There is not likely to be a radical change

throughout the country. There is a possibility of radical change in a small area, however, and for this reason market analysis is essential to the establishing of proper quotas.

The smaller the unit under consideration the greater the possibility of variations in the prediction made solely on the basis of past performance, because the accuracy of the prediction depends chiefly upon the occurrence and balancing of many plus and minus factors over a long period.

Therefore the third step in establishing quota is to make a thorough territorial analysis of each distributor's territory. This analysis will consider all those factors affecting sales. The method of making it will be discussed in a following article. Thus the maximum sales possibilities will be determined for the given price class in the given territory. This number is based on an *absolute*, not on a *relative*, study.

If the Sennett company has sold 5 per cent of the cars in its price class during the preceding year, it is fair for practical purposes to apply that percentage to the absolute figure determined as a result of the market analysis of an individual territory just discussed.

When this is done, the resulting figure will give the economically possible Sennett sales for 1922 in the given territory. This figure will serve the factory as a fairly accurate standard of performance.

Human factors are not equal in all territories, however, and the quota actually set up for the distributor should be established after considering the personality and ability of the distributor, the general attitude of the public toward the car in the given territory, etc. The result of this adjustment will give the actual quota.

The sum of these actual quotas should be somewhere near the probable Sennett production figure previously determined on the basis of past performance. If there is a wide discrepancy adjustment should be made in both the production and the quota schedules.

TOO frequently the possible uses of a properly established quota are not recognized. Usually, passenger car quotas serve no purpose other than that of furnishing some basis upon which to distribute a predetermined production of cars. Sometimes the quota is used to check up distributor performance to a certain extent. Quotas as now established in most cases, however, do not constitute proper standards by which to gage sales performance.

The scientifically established quota, however, has a practical financial and economy value. It can aid in determining what shall be the production for the year, which will in turn enable the manufacturer to take advantage of long range buying, to stabilize his labor force, to facilitate financial plans and to increase production and marketing stability all along the line.

The absolute quota can serve as a maximum performance standard in each territory, while the actual quota, which includes consideration of the human factors, can serve as the guide in establishing production.

The market analysis serves as a check on the probable production figures and vice versa. The probable production estimate cannot take into account very unusual circumstances, economic or human, which may arise in a given territory, in the management of a given company, or in the design of a given car. The market analysis can take into account these factors.

The basis of establishing quota and the various steps in the procedure may be summed up as follows:

1. *Probable* total price class production can be determined from past performance (A. I., Dec. 22, 1921).
2. Probable Sennett percentage of total price class production can be determined from past performance (A. I., March 23, 1922):
3. Distributor's absolute territorial possibilities can be determined from territorial analysis. That is, maximum price class possibility in territory can be determined on absolute basis.
4. For practical purposes, probable Sennett percentage of total price class production (No. 2) can be applied to individual territory.
5. This will give an absolute quota or economically possible Sennett sales in given territory for 1922.
6. Actual quota can then be established by considering dealer ability, etc., in connection with absolute quota.
7. Sum of actual quotas should be somewhere near total Sennett U. S. production. If not, adjustment should be made both in production and actual quota schedules.
8. Sum of absolute quotas and separate absolute quotas serves as a standard of performance.

With this outline of procedure in mind, the next step is to consider in some detail the matter of actual market analysis and methods of correlating the factors involved.

Tire Market in Yokohama, Japan

IT is estimated by Consul General Scidmore, Yokohama, in a report to the Department of Commerce, that there are between 7500 and 8000 passenger automobiles in Japan, 5500 of which are in and around Yokohama. Of this number 25 per cent is equipped with metric clincher tires, 40 per cent with inch clinchers, and 35 per cent with inch straight sides. American-made straight-side tires are freely available in the district, while Dunlop's branch factory at Kobe and the Yokohama Rubber Co. are now making this type.

While American firms are still shipping some cars to Japan, the last 18 months has shown a marked decrease. As yet no cars other than American have come in on straight sides. There are about 3000 motor trucks in the country, of which 2200 are in and around Yokohama; 20 per cent of these trucks operate on pneumatic tires, while 80 per cent are equipped with solids. The tires manufactured by the Dunlop branch factory at Kobe, financed by English and Japanese capital, dominate the market. Most of the imported tires are of American manufacture.

Straight-side tires are very little used in Japan, for the reason that Japanese chauffeurs—there being very few owner-drivers—always run on underinflated tires—about 45 pounds for a 4-inch tire—because of the better riding conditions secured by this practice. The straight-side fabric tire soon breaks down under these conditions. Cord tires are not used because of the high price and the fact that there are no facilities for repairing them in Japan.

Powerplant in New Stutz Model Incorporates Many Changes

Lighter pistons, redesign of jackets and cylinder head and better fuel vaporizing means, among other changes, have resulted in increasing the power, speed and fuel economy. Heavier crankshaft, machined combustion chambers and stiffer cylinder block help minimize vibration.

By J. Edward Schipper

A NUMBER of changes have been made in the Stutz car, particularly in the powerplant. The latter have resulted in increased power output from the engine, lower fuel consumption, better comparative acceleration and hill climbing ability and higher maximum speeds. The changes are not radical in any sense, but include the adoption of up-to-date construction in the way of lighter pistons, better handling of the fuel, the adoption of detachable head construction and better design of the cylinder block with respect to the circulation of water, resulting in elimination of hot-spots or steam pockets.

Power output is now 50 per cent greater than before while the speed range has been increased at both ends, being five miles per hr. as compared with 10 miles per hr. at the lower end and 75 miles per hr. as compared to 60 miles per hr. at the other extreme. Cold weather performance has been improved by the adoption of a new vaporizing device. The chassis is now more quiet, due to the extensive use of anti-rattle features throughout the chassis, and the accessibility of a number of units has been notably increased as hereinafter noted.

The pistons are now considerably lighter due to decrease in length and thinner walls. The piston pin is a floating type, the pin being retained by means of a groove and spring retainer as heretofore.

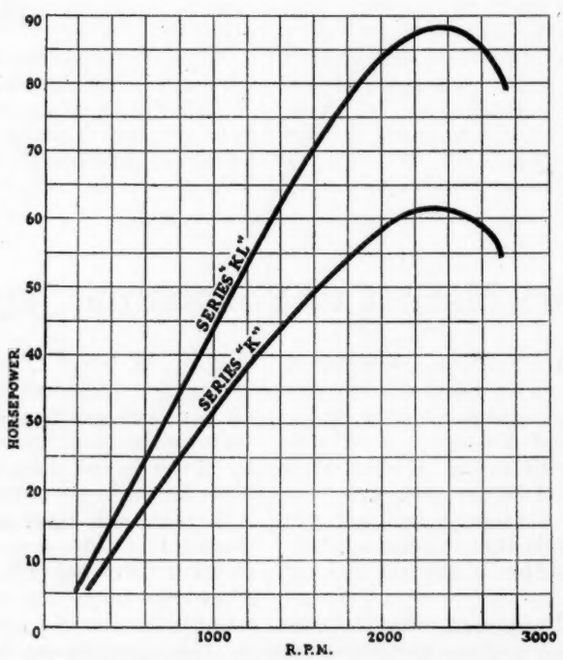
The connecting rods are 14 in. in length from center to center. The crankshaft diameter has been increased by ⅜ of an in. The bearing lengths of the crankshaft are now 3⅜ in. at the forward main bearing, 2¾ in. at the center main bearing and 4½ in. at the rear main bearing, while the diameter is 2½ in. The bearings are supported in the aluminum crankcase and in addition there is a reinforcement by means of special shoulder bolts which run completely through the crankcase to the cylinder block, thus tying the entire structure together.

It is estimated by the Stutz company that the rigidity of the crankcase has been increased by 50 per cent. This has been accomplished by extensive ribbing.

The inlet manifold is designed to create an eddy in a circular chamber. The liquid particles are broken up as they come in contact with the hot internal fins. These fins are heated by exhaust gas drawn through a tube running directly across the engine between the central cylinders. This tube is in a dead air pocket, which tends to decrease radiation from the tube itself and permit a maximum amount of heat to be carried over to the heated fins. The heated fins of the intake are placed at an elbow, so as to trap the liquid particles in the intake stream without adding much heat to the air.

New Intake System

The intake has been designed with the passages sloping away from the cylinders so that all drainage is back toward the carbureter, and the manifolding is cast in aluminum in order to take advantage of the good heat conduction properties of this metal. The intake manifold is attached to the engine by means of an aluminum flange intended to transfer heat from the engine to the intake system. About one-fourth of the exhaust is used to heat the inlet, the arrangement being such as to prevent undue back pressure on the exhaust. The exhaust pipe is carried forward toward the radiator, in order to help keep the engine heat out of the front compartment of the car.

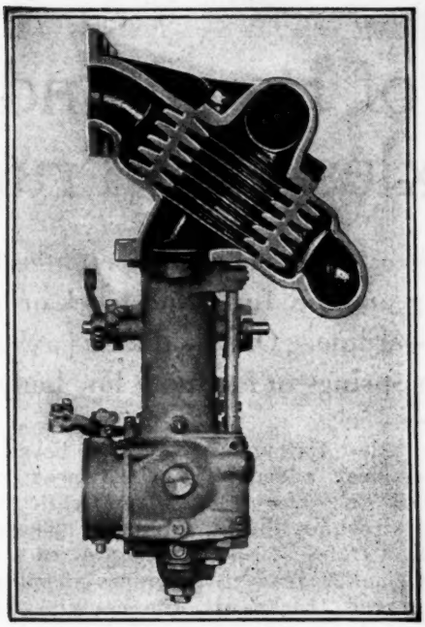


Horsepower-speed curves showing how the new series "KL" engine compares in performance with the earlier model "K."

The adoption of a detachable cylinder head has permitted the use of completely machined combustion chambers, with resultant equalization of cylinder compression and consequent decrease in vibration. The ability to secure smoother surfaces in the combustion chambers has also resulted in less adhesion of carbon particles and in more uniform cooling of the chamber walls. The cylinder head is extensively ribbed and a large number of studs are used to hold it in position and prevent gasket leakage.

The water spaces have been designed to produce small ed-

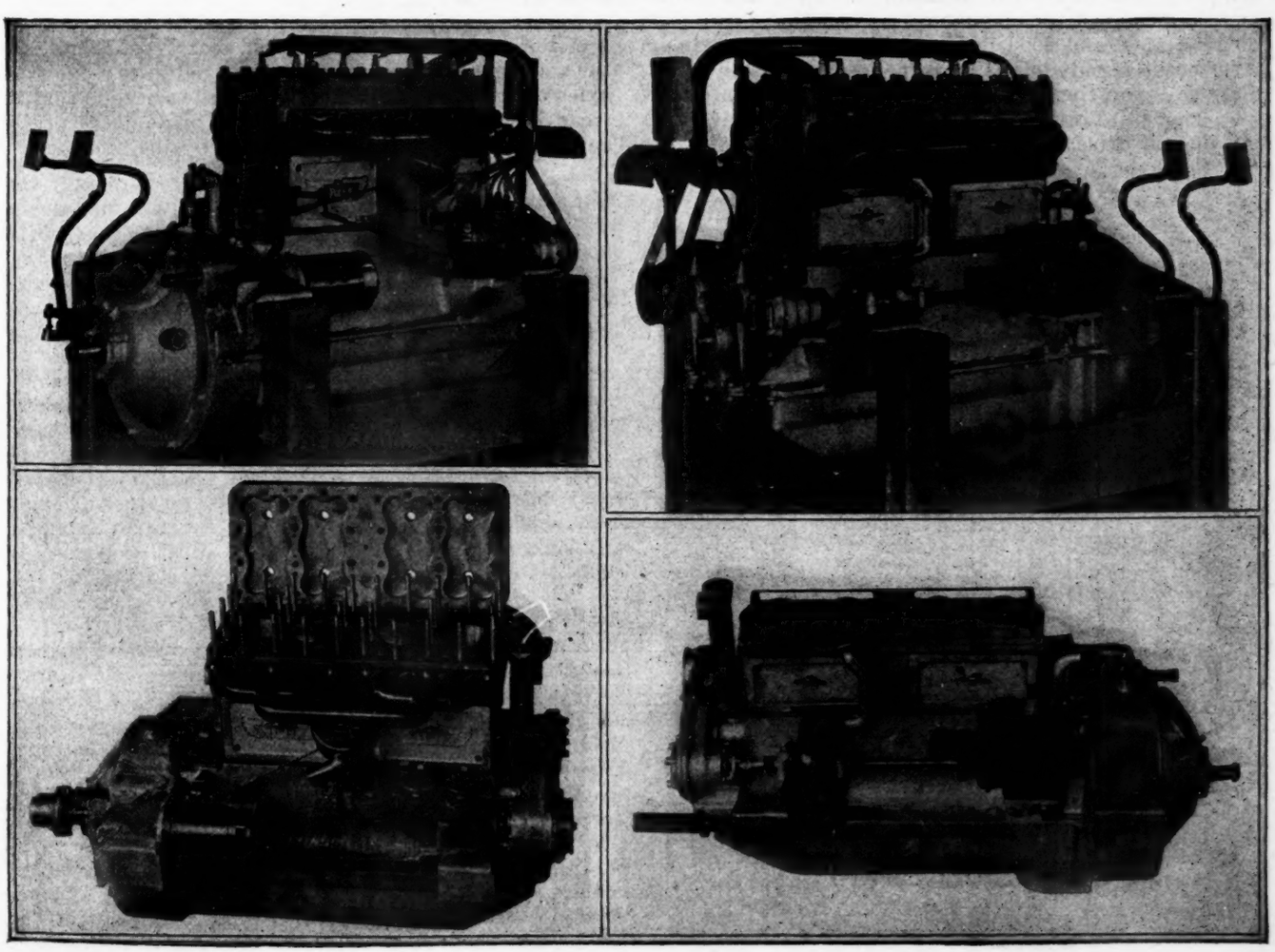
dies within the main body of water in order to equalize the cooling effect. The water is circulated by centrifugal pump. The fan incorporates a centrifugal feed oiling system, which carries a supply of lubricant sufficient for a season's running without replenishing. A pressure feed lubricating system distributes oil through integrally cast steel tubes, so that exposed tubing, unions and solder joints are avoided. The oil leads run to the hollow crankshaft and also the camshaft bearings from which oil is sprayed constantly upon the valve operating mechanism. The entire distribution system is lubricated by oil supplied through the hollow stud of the central idler gear of the six-gear train. Since the engine has four valves per cylinder, there are two camshafts. The idler gear has holes drilled from the hollow stud to the face of the gear. Through these holes, oil under pressure is fed directly to the meshing gear surfaces and thence supplies the entire forward gearcase.



Sectional view of the exhaust heated inlet manifold used on the new Stutz.

The auxiliaries are now arranged so that the twin ignition unit is driven from the timing case, but is entirely separated therefrom. The water pump and generator are on the opposite side of the engine and are now completely accessible without disturbing each other. These units are driven by auxiliary shafts provided with flexible couplings. The starting motor is also mounted individually to increase the accessibility. The ignition is the Delco dual synchronized system, with two spark plugs for each cylinder located in the center of each half of the combustion chamber.

The chassis and general construction of the Stutz car embody few changes outside of those in the powerplant. The cylinder dimensions are 4⅜ by 6 in., the engine being a T-head type. The clutch is a Warner, the gearset is of Stutz manufacture, providing three forward speeds. The car is driven through a torque tube with a single universal joint. The gearset is mounted in unit with the rear axle, and in order to obtain quietness all of the constant mesh gears are ground. The car weighs, with the seven-passenger touring car body, 4010 lb. The wheelbase is 130 in. and the tire size 32 by 4½ in. all around.



Four views of the new Stutz powerplant showing type of manifolds, redesigned cylinder head, increased jacket space and several other modifications.

A New Line of Bevel and Internal Gear Axles for Trucks

Seven new axles, three of the bevel gear type, intended for light trucks, and four of the internal gear type, for either truck or bus chassis, have recently been added to Russel line. One of the bus axles is arranged for 71 in. tread and underslung springs to facilitate low body mounting.

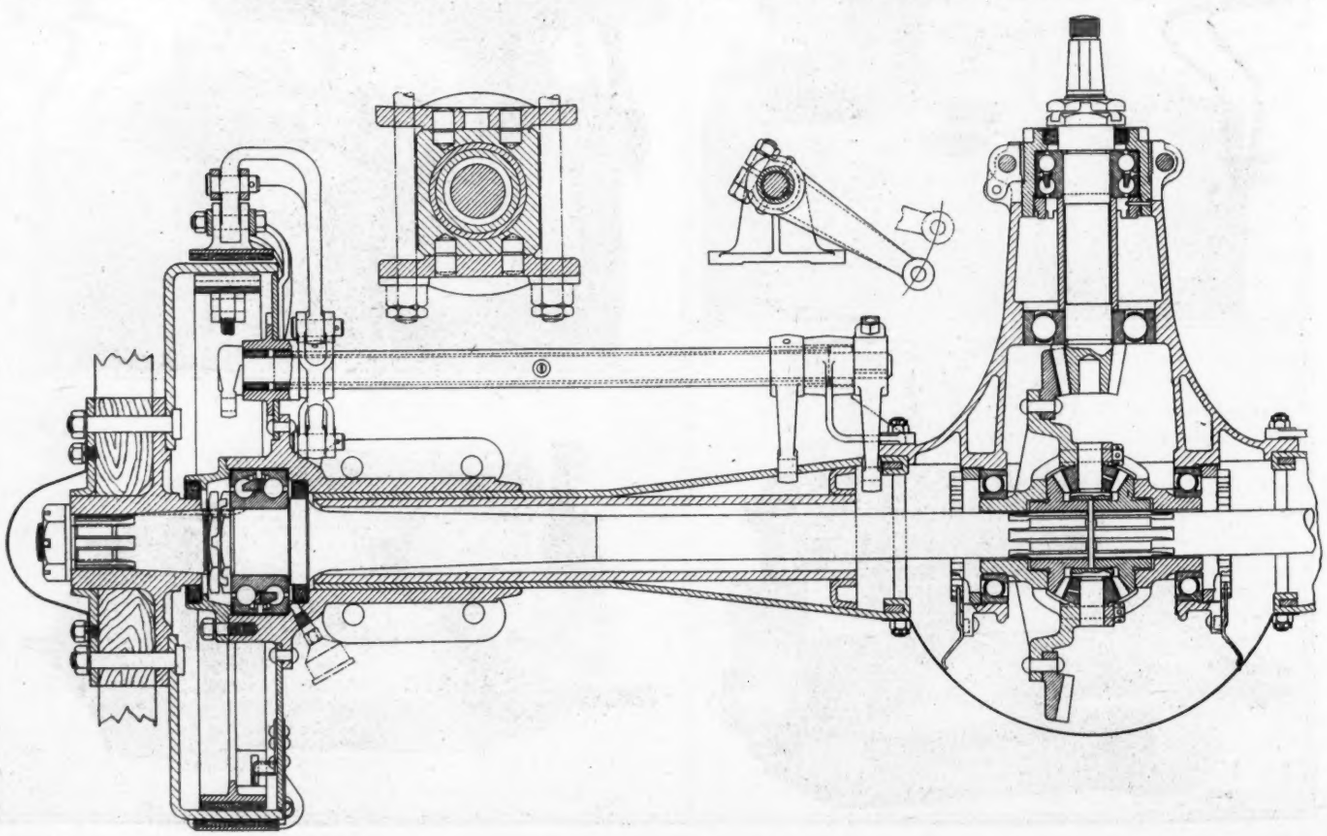
THREE new integral gear-drive axles for pneumatic tire equipped trucks have been added to the line of the Russel Motor Axle Co. The new models are very similar in design to the regular line of Russel axles described in AUTOMOTIVE INDUSTRIES of Nov. 10, 1921, but have larger brakes and smaller gear reductions, making them suitable for speed trucks or buses. In addition to these, three entirely new bevel gear axles for pneumatic tired trucks have also been added. These embody several features which are new practice for the Russel company. These six new models are now in production.

The three new double reduction, internal gear axles are for trucks of a nominal rating of 1, 1½ and 2 tons, and are designed for maximum loads on the spring pads of 4500, 6500 and 8000 lb., respectively. The maximum axle torque permissible is 5000 in.-lb. on the 1-ton model, 8250 in.-lb. on the 1½-ton model and 9000 in.-lb. on the 2-ton model. These axles are all designed to have both torque and drive taken through the springs.

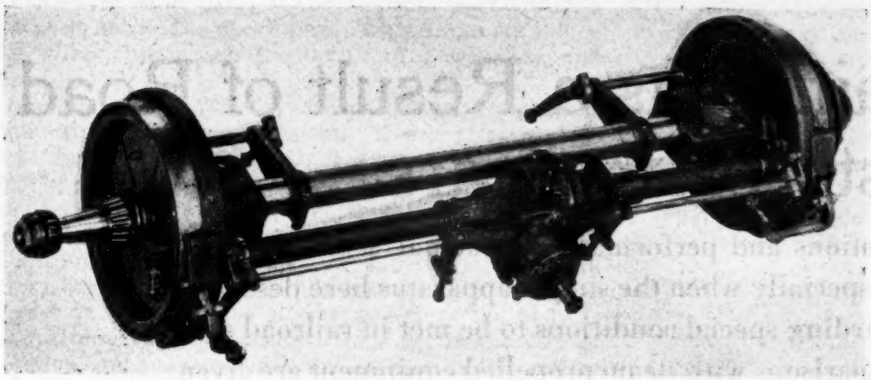
Of the bevel gear axles, the smallest one is intended for the speed truck type of vehicle having a capacity of ¾ ton, while the larger axles are intended for 1¼-ton vehicles. These axles are all of the semi-floating type with pressed steel housings reinforced by heat treated, chrome nickel steel tubes extending to within 7 in. of the center. The housing is ribbed and electrically welded over the entire length. The ribs are riveted and at the center of the housing nickel steel bolts extend through both sides to insure rigidity.

The differentials are of nickel steel with spiral bevel drive gears of coarse pitch. The axles are mounted on ball bearings and are equipped with both internal and external brakes.

Another new product of the Russel Motor Axle Co. is a motor bus axle of the internal gear type. This is of the same general design as the internal gear drive truck axles of the company. One of the differences is that the tread is wider, being 71 in. This is made necessary because of the fact that bus bodies are wide and must be



Sectional view of the new bevel gear Russel axle for light trucks



The new Russel internal gear axle intended especially for bus applications

placed low. For the same reason the springs are underslung. The load to be carried by the rear axle is equivalent to that of a 2½-ton truck. Because of the frequent stopping, it has often been found desirable to use both the internal and external brakes for service work and to install an emergency brake at the rear of the transmission. This is said to impose greater loads upon the differential and drive shafts. Bearings of increased capacity have therefore been provided for the bevel pinion, and the single row bearing adjacent to the bevel pinion is of a larger series than that for the outer bearing.

The drive shafts are increased in diameter to provide against additional deflection because of the increased length. Taper roller bearings are used in the wheels and the recently adopted S. A. E. recommendations for wheel bearing mounting have been used.

It is gratifying to note that the axle manufacturers are sensing the growing demand for motor buses and are doing their part to meet the special requirements of that particular line of motor transport.

SPECIFICATIONS OF NEW RUSSEL AXLES

Model	Nominal Rating Without Load	Maximum Load on Spring Pads in Lbs.	Diameter of Brake Drum	Gear Ratio
Internal Gear Types:				
3000-SI	1 ton	4500	15½	6.15 to 1
4500-SI	1½ ton	5500	16½	6.6 to 1
6000-SI	2 ton	8000	18	7.4 to 1
Bevel Gear Types:				
2400-B	¾ ton	3400	15½	6.33 to 1 5.28 to 1
3000-B	1 ton	4000	16½	6.33 to 1 5.28 to 1
3600-B	1¼ ton	4600	18	6.33 to 1 5.28 to 1

A Large Double-Crank Toggle Press

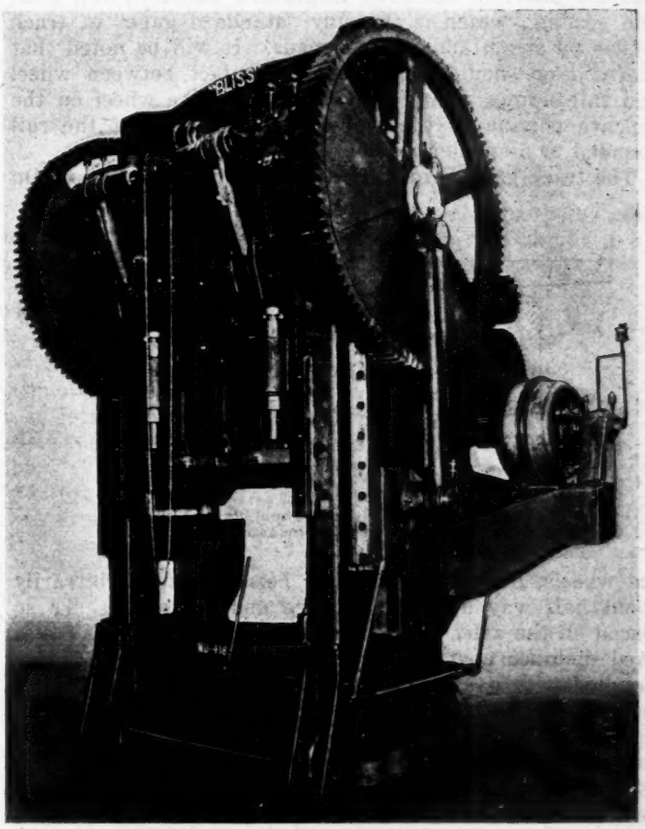
DURING the past several years rapid strides have been made in the use of steel stampings for all classes of light machinery, and particularly in the automobile industry. The use of stampings has been extended to lines of industry dealing with very large units, and to keep pace with this progress the manufacturers or builders of power presses have put out machines of sizes and capacities that a few years ago were not dreamed of.

The accompanying illustration shows a double crank toggle drawing press recently completed by the E. W. Bliss Co. It is of tie-rod construction, twin-driven and triple geared, and has a gear ratio of 85 to 1. The gears are all of steel and have machine-cut teeth.

Power is transmitted from the main drive gears to the outside slide or blankholder through a series of toggles, and a dwell of 120 deg. is obtained. The number of toggles and connections used is said to be the least possible for efficient results. In wide presses, to avoid torsional strain, the power is transmitted to the outside slide from both ends of the press. This method is also followed out in connection with the crankshaft which operates the inner slide, this being twin-driven by means of a gear on each end.

The small number of connections or links used in transmitting power to the outer slide makes for economy in power consumption, and to minimize wear in the connection pins they are hardened and ground. Adjustment of the inner slide or plunger is made by a 15-hp. motor mounted on the front of the crown. The machine itself is driven by a 100-hp. motor and operated by a powerful hand-actuated friction clutch of the double-grip type, by means of which the operator has the moving parts at all times under control.

The photograph gives an idea of the huge size of the machine here described, some of the principal dimensions of which are as follows: Distance from bed to the inner slide with the stroke down and the adjustment up, 59 in.; distance from the bed to the outer slide with the stroke down and the adjustment up, 56 in.; stroke of inner slide, 28 in.; stroke of outer slide, 20 in.; area of bed, 60 by 116 in.; area of face of blankholder, 60 by 102 in.; area of face of plunger, 36 by 86 in.; weight, about 600,000 lb.



Bliss double-crank toggle press

Experience Gained as a Result of Road Tests of Railcars

Information as to limitations and performance in actual service can be gained from such tests especially when the simple apparatus here described is employed. Data regarding special conditions to be met in railroad service and some useful comparisons with steam propelled equipment are given.

By Donald A. Hampson

RAILCARS are subjected to road tests for much the same reasons that other automotive vehicles are, and for other reasons peculiar to railroad conditions. These reasons may be summed up as follows:

1—To note the action and fit of wheels on the rails.

2—To locate any weakness or maladjustment in the car structure or power line.

3—Speed test.

4—To run in various working parts.

5—To determine the power as a self-propelled unit and as a motor car.

6—To furnish ocular proof of "roadability."

7—Braking tests.

8—To compare actual performance with theoretical data.

No. 1 includes a variety of details. The gage of an automobile is relatively unimportant—the "gage" of railroad wheels is of vital importance. Fig. 1 shows the elements of wheel and rail mating; the former is the standard adopted by the Master Car Builders' Association and the latter is the Civil Engineers' shape of rail head and spacing, which is the only "standard gage" of track in use by steam and electric roads. It will be noted that there is no shoulder to shoulder contact between wheel and rail simply rolling contact between the wheel on the concave portion of the flange with a corner of the rail rounded to a smaller radius.

The track gage is measured between vertical faces. On

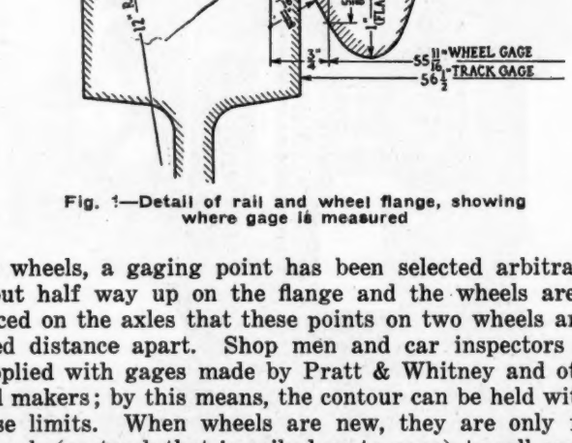


Fig. 1—Detail of rail and wheel flange, showing where gage is measured

the wheels, a gaging point has been selected arbitrarily about half way up on the flange and the wheels are so placed on the axles that these points on two wheels are a fixed distance apart. Shop men and car inspectors are supplied with gages made by Pratt & Whitney and other tool makers; by this means, the contour can be held within close limits. When wheels are new, they are only free enough (on track that is spiked up to gage) to roll easily; as they wear, the flange takes on the curve of the rail head, allowing greater freedom, until the wear amounts to about ¼ in. at the gage point when, according to "Rule 74," the wheel is condemned and taken from service.

Now, wheel gage is not such a serious matter within the M.C.B. limits, but taken in conjunction with worn rails, track out of gage, rotted ties, the allowance made on curves and special track work for the long rigid wheelbase of locomotives, it merits all the attention given it. If the tread of a car wheel (see Fig. 1 for the difference in application of the term) is narrow or broken out and the flange on the opposite wheel is badly worn, the wheel on the inside of the curve can run off and drop between the rails. A wheel hub out of true, a slightly bent axle, bolts unevenly drawn up, a wheel inaccurately machined—any of these causes would be passed over as unimportant on a motor truck (probably laid to the rubber tire), but might result in derailing the same truck if placed on the railroad.

Wheel Tests on Track

Hence, it is very desirable to test newly assembled wheels on a track that is right. If this track happens to be the road that is to use the car, a trip should be made over it regardless of previous tests and, in so doing, particular attention paid to those sections which are known to be badly out of gage. Spring frogs should be given careful attention if there are any that the motor car has to open; a frog may have its spring set up so tight that the relatively light weight of a motor car will not let the flange open it, and derailing will result.

Wheels for steam roads have a wide tread which projects outside the rail when both are in correct relation. If this same wheel were run over street car tracks, the projecting tread would soon ruin the bricks of pavement laid close up to it. For this reason, and because the confined location helps keep the track to gage, most street car wheels are made with a tread of only 2½ in., with interurbans an average of 3 in. Street car flanges of the A.E.R.A. standard are approximately one-fourth less in size than the one shown by Fig. 1. The openings in the grooved rails can therefore be less, making a smoother street for other vehicles, and the tendency to fill up with street dirt is not so serious.

It is necessary to know the details of track structure when supplying the wheels for a railcar. It was doubted in one case we have in mind whether a gasoline railcar could make a certain hairpin curve of but 36 ft. radius. This curve had a rise of 10 ft. between tangents and, with the two grooved rails, the wheel friction is so high that electric cars draw an average of 200 amperes in passing the curve. The motor railcar had flanged steel rims with proper size of flange for the rail. In spite of the fact that the curve was greased, the car made it without trouble; its construction avoided entirely the cause of the enormous power consumption with electric cars and their

fixed axles—the differential at the rear and the swivelling front wheels enable the car to pass such a curve with none of the wheel slipping so productive of power loss and stresses.

A few hours or a few days spent in test running of different kinds is time well spent. Every piece of machinery "finds" itself after a limited amount of usage in the field of its application and then requires minor adjustments, taking up of nuts, refitting, etc. Moreover, dynamometer or similar tests do not reflect the true conditions until the first newness is off and lubricants begin to act to best advantage. In the case of a railcar, it is far easier to give it these attentions before the body is on than afterward, when other fittings are in the way of both action and observation. Then, there is the matter of finish. The spatterings of oil and grease on a bright new body coat leave unerasable marks when mixed with the dust from the roadbed.

Maintaining Scheduled Speed

Speed is a detail that may be foretold with accuracy. That is, mere speed in miles per hour. But ability to maintain a schedule is quite another matter. Whether a car can be handled, with ordinary help, at terminals in the lay-over time allotted; whether it can accelerate at so many miles per hour per second, without slipping the wheels when the load is light and has sufficient power for this same acceleration when the car is overloaded; whether the brakes are so designed as to permit a high rate of deceleration; whether due regard for other traffic shatters a time card when the machine is driven by a man of average skill and temperament—these are points that must be considered in connection with speed. The best time for a conclusive speed test is on a damp day—rails are then greasy, carburetion may be slightly affected, other traffic need greater attention—a run on schedule time on such a day is the best evidence of a car's performance under adverse conditions—and a run with chassis only should include several seconds extra time at each stop to allow for the slowness of passengers bundled up and with dripping umbrellas.

Speedometer readings are an aid to the driver, once he has learned the road and knows what time he must maintain between stops to make his schedule. By a glance, he knows whether it is necessary to speed up a few miles per hour to make up for a lost minute or two.

Correct Speedometer Drive

In many cases, a change from rubber tires to metal wheels involves also a change in diameter; sometimes there is made a change in gear ratio as well. In such cases, the gears driving the speedometer cable must be changed. The best arrangement for speedometer drive on railcars is one off the transmission shaft.

Running in is a part of the general road test, as mentioned above. It has another significance from the railroad standpoint, namely, smoothing up the rail surface of the wheels. It is customary in railroad car practice to send passenger coaches out on a slow freight, for a fifty-mile run, after new wheels and axles have been put in before putting them in high speed service, so the wheels will become polished and lose that disagreeable noise peculiar to them without it.

Fig. 2 shows a 1922 Model 30 Gramm-Pioneer 3-ton railcar chassis as taken out for road tests. The weight of the car as illustrated is 6300 lb., of which 2900 is at the base of the rear wheels. The body for this car, with maximum seated load, totals 7800 lb., most of which comes on the rear wheels—this gives a high factor of adhesion for the car in service, which could not well be realized during the tests, though 1100 lb. of old rails were piled over the rear axle to increase traction at the time. Drivers are of iron with chilled treads, selected because of their economy and wearing qualities and in preference to steel whose slightly greater adhesion was of little moment with an engine of the size employed. Stock cab, fenders, muffler, and step later give way to body, special wheel guards, heater pipes, step inside body, etc. Fire extinguisher, bell, sanders, lights, and couplers, remain to be added.

This Gramm model has a 4¼ x 5½ engine. The gearset is four speed, with individual clutches. Wheels are 33 in.

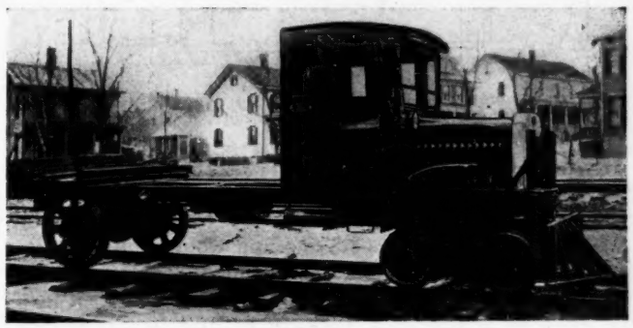


Fig. 2—The Gramm-Pioneer railcar chassis used in one of the tests described

in diameter and the worm drive has a reduction of 4½ to 1, which is the overall high speed ratio, with a low ratio of 21.3 to 1. Conservatively figured, the tractive force delivered at the circumference of the drivers is 282 lb. on high, increasing to 1130 lb. on low. Taking a value of 25 lb. per ton as the starting resistance of the (new) truck on the rails, its total resistance with two men is practically 100 lb., which must be subtracted from the 1130 lb. above in calculating the amount of pay load which can be hauled on or behind the chassis. The weight at the drivers is 4000 lb. The coefficient of friction between iron wheels and steel rails may be taken as .24 when dry and clean, which gives us a theoretical available tractive effort of 960 lb., and as this is less than the 1130 lb. delivered by the engine, the latter can slip the wheels.

Drawbar Pull and Tractive Effort

In locomotive practice, "drawbar pull" and "tractive force" (or "tractive effort") are widely different terms, tractive force being the sum of the available drawbar pull and the resistance of locomotive and tender. For instance, 57,200 lb. is the rated tractive force of the newest Mountain type passenger locomotives on the Norfolk & Western; these are in service on a 150 mile run out of Roanoke with grades as high as 1.32 per cent and haul a 577 ton train at an average speed of 40 miles per hour. The locomotives weigh 257 tons, which at that speed offers a resistance of 2570 lb. on a level tangent as against a resistance of 4000 lb. for the train under the same conditions. The sum of 2570 and 4000 represents the tractive effort expended at the time and of this about two-fifths was expended in moving the locomotive and tender while the remainder (4000 lb.) is the drawbar pull. A power unit offers more resistance than a pulled unit of the same weight.

The railcar was first attached to a 26-ton box car. Cold and in average condition, such a car has a starting resistance of 650 lb. This box car was started easily and without perceptible slip of the driving wheels—its resistance plus that of the motor car is considerably less than the available tractive effort. Once under motion, the speed was brought up to that of the next gear and the clutch shifted.

The next heavier car in the railroad yards, convenient at the time, was a steel gondola stenciled "Wt. 72,000 lb."

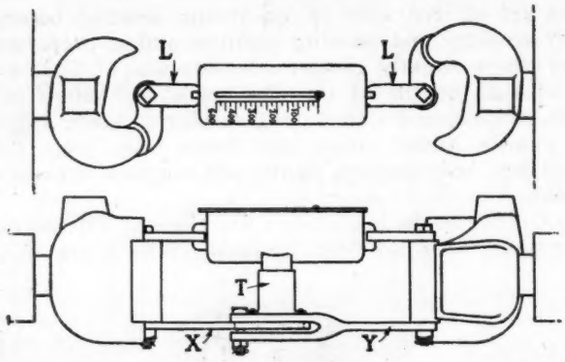


Fig. 3—Sketch showing simple form of drawbar dynamometer which can be used to advantage in road tests of railcars

The resistance of this plus that of the Gramm itself is just 1000 lb. Backing the railcar up to the gondola, it was found that the wheels slipped and would not start the latter. But when the rails were sanded, it was possible to move the gondola and to reach a speed at which a gear shift could be made in a distance of 100 feet. A poor driver could not have attained this result, for he would have raced his engine, thus spinning the wheels and lowering their adhesion greatly—a good driver, on the other hand, was able to show in practice 100 per cent of the theoretical power, or nearly that, as judged from the tests.

Test Device for Railcars

Fig. 3 shows a device used to check the resistance on one railcar when hauled by another or the drawbar pull exerted by the forward car. It is so arranged that an observer can occupy a position of safety throughout the run and take readings from the start up to the maximum speed of the power unit. Shoulder bolts were made up to pass through the hole in the coupler knuckles and two pairs of links fitted to these, the links *L, L* being attached to a spring balance, and links *X* and *Y* providing the safety feature. Link *X* is slotted so that a bolt through the fork end of *Y* will strike the end of the slot in either direction before the upper links can be drawn out so far or pushed together enough to damage the scale.

A piece of pipe *T* is attached to the upper face of the link *Y* and inside it is a spring plunger with a concave top face partially surrounding the spring balance case and supporting the latter so that its weight does not cause binding and possible error from that source. The advantages of such a test unit for motor cars are at once apparent. With fuel carefully gaged, it is possible to determine the consumption with light loads and heavy, over divisions with numerous grades and curves, to check theory with practice, and to plot performance curves of direct value. The decreased resistance of a car after it has been in service a couple of months may be noted and this, compared with fuel consumption, will show whether or not the engine is showing an economy in proportion and when a tuning up is necessary to maintain engine efficiency. A device of this kind does not interfere with train operation and it forms an inexpensive, quite reliable means of collecting data for those who are removed from or cannot afford dynamometer tests. It will show, among other things, that a country which "looks level" is neither flat nor level, but slopes enough to create a track grade of one-half per cent or more.

It is not suggested that any rail motor cars be used for moving freight cars—such action ought to be vigorously discouraged—but the freight cars serve as a convenient means to an end.

Railcars ride smoothly, as quietly as any passenger coach on a branch line, show an acceleration equaled only by an electric car, and dispel entirely the ideas formed by riding on a locomotive or motor truck or a bus.

Braking Tests

Braking can be demonstrated and tested as a portion of road tests. Without a weight equal to the full load or the body load on the rear, the front wheel brakes assume the greater share of the work during a test. In fact, to insure 100 per cent braking on a railcar, commercially at least, front wheel brakes are absolutely necessary. The average running time is increased by good brakes and high braking pressures. Air brakes supply this need more thoroughly than manually operated brakes. An advantage of the air brake is that it is not subject to fatigue, as is a driver; further, it is possible to more easily effect a gradual release of brake pressure as speed decreases and the coefficient of friction rises, maintaining throughout the most effective pressure which is at a point just before the wheels begin to skid.

In conclusion, there are a few suggestions to be made that will assist in daily service, which is the real road test of the road car. Truck and automotive units are not available out of stock to give a high enough road speed except by the use of large wheels. Large wheels increase the floor height and raise the center of gravity. Wider use of rail cars will come when there is available an axle that is geared higher, is more rugged and simple, and comes minus the differential.

Service

More and better service will be realized from rail cars when a separate department, though small, is created for their maintenance. To expect a freight car repairman or a mechanic used to rough work on thousand pound locomotive parts to intelligently cope with adjustments and repairs on the railcar is unreasonable, to say the least. The truth of this is found in air brake work which more nearly approaches automotive work in size and accuracy than any other work done in railroad shops. Such work is handled by separate groups of workmen who make a specialty of this and are provided with all necessary facilities for repairs and testing, housed in separate departments under highly trained specialists.

Resistance of Battery Separators

MEASUREMENTS of separator resistance on a number of samples of different kinds of wood which were submitted by the manufacturers have been completed by the Bureau of Standards. A comparison of these results with those obtained on similar samples last May shows excellent agreement and proves that the method for measuring the resistance is reliable. The soft woods, such as poplar and basswood, have the lowest resistance; cedar and cypress, on the other hand, have considerably higher resistance, but are known to have better lasting qualities when used in storage batteries.

In determining the durability of the separators in sulphuric acid solutions of different densities, a number of samples have been cut to a specified size and immersed in an acid solution of known concentration. One set is being kept at room temperature and a similar set at 45 deg. C. At the end of periods of one month, three months and six months samples will be withdrawn from the solution to determine the decrease in tensile strength of the separator material.

Design and Functioning of Laminated Automobile Suspension Springs

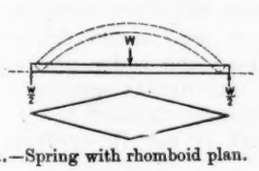
Part I

The character of laminated springs as well as their theoretical and actual functioning is dealt with herein. The author offers suggestions for improvement in design and urges a more serious consideration of the subject.

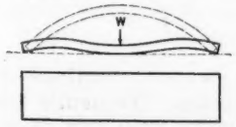
By A. A. Remington*

THE actual invention of laminated springs is shrouded in mystery. They were undoubtedly first used on the road vehicles probably invented for them, as at the date of their invention, about the year 1750, no other types of vehicles existed. Between the years 1750 and 1790 laminated vehicle suspension springs came into general usage, and we find that in the year 1768 Dr. R. L. Edgeworth was awarded three gold medals by the Society of English Arts and Manufactures for demonstrating the advantages of sprung vehicles, and in the well known work by William Felton entitled "A Treatise on Carriages," published in 1790, it states that an industry for the manufacture of laminated carriage springs had at that date been started.

The modern conception of elasticity, with particular reference to springs, appears to have begun with Robert Hooke about 1678, and he was followed closely by Mariotte, who in 1686 originated the term "fiber stress." In 1744 James Jurin published a paper entitled "On the Action of Springs"; but the most important investigator in connection with laminated springs was a Frenchman, by name E. Phillips, whose researches were published in 1852 in the *Annales des Mines*. Phillips applied the theory of elasticity to the particular case of the laminated spring, and was the first to propound the rhomboidal plan for a beam of uniform thickness and uniform stress, and



A.—Spring with rhomboid plan.

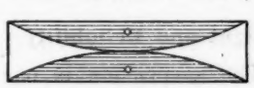


B.—Spring with rectangular plan.

FIG. 1

A.—Beam of low flexure.

$Z = \frac{bt}{2} \times \frac{2}{3}t \times \frac{1}{2} = \frac{bt^2}{6}$



B.—Beam of high flexure.

$Z = \frac{1}{2}$ (area × moment) $= \frac{bt^2}{4}$

FIG. 2.

to demonstrate the sub-division of the rhomboid into a series of laminations to form a laminated spring.

The data found in all our modern pocket-books, and most of the scanty treatment of the subject in more pretentious text-books, are based on Phillips' work, slightly amplified by later writers, and it is time the subject was given the independent and serious treatment which it deserves.

A semi-elliptic spring is a special case of a beam. Assuming it to be loaded at the center and supported at the ends, and that it is flat when loaded, the bending moment is $WL/4$. The condition of maximum economy is fulfilled when all the material is uniformly stressed, which in a beam occurs when the resisting moment is equal to the bending moment on all sections. Phillips showed that this condition is complied with for a beam of uniform thickness when the plan is a rhomboid, and a beam of this form, if cambered to a circular curvature, will lie flat when loaded as shown at *A*, Fig. 1, whereas a similarly cambered rectangular section beam will take the form shown at *B*, and will not lie flat from any camber. The beam shown at *B* contains twice the material of beam *A*, and for a given deflection the maximum change of curvature is greater, and therefore the greatest stress is higher.

The spring shown at *A*, Fig. 1, although flat and touching its support all along, will only bear on it at its tips, and the pressure will be $W/2$ at each end.

The resisting moment Z of a beam is $\frac{1}{2}I$, and for a rectangular beam under static conditions this value is $bt^2/6$, the formula being derived from the stress triangles as shown at *A*, Fig. 2, from which it is seen that—

$$\frac{1}{2}\ I = \frac{bt}{2} \times \frac{2}{3}t \times \frac{1}{2} = \frac{bt^2}{6}$$

As applied to beams of small flexure, say a maximum of 1 to 400, this formula is found to be sufficiently accurate. For spring plates, however, which in extreme cases may deflect as much as 1 to 5, and rectangular beams having considerable flexure, it is extremely doubtful if it holds good without modification, as the stress is far from uniform throughout the section, and consequently the beam does not behave as one composed of two triangles, but more of the section becomes effective and modifies the conception to a form approximating that shown at *B*, Fig. 2, and with it the formula expressing the stress, which in extreme cases may become $bt^2/4$.

Tests made on spring blades show that the stress cannot be so high as the results given by the unmodified beam formula, as single blades will, without taking a permanent set, carry loads representing a fiber stress as calculated by this formula approximating their maximum tensile strength. For example, the standard test provided for carbon steel railway springs** necessitates a theoretical stress of 68 tons per sq. in., and allows a margin before permanent set takes place in a properly tempered test piece of about 15 per cent.

*Paper presented to the Institution of Automobile Engineers. Slightly condensed.

**B. E. S. A. report No. 24, part 3, pp. 6 and 7.

Phillips showed that a rhomboidal beam can be cut longitudinally into any number of pieces superimposed as shown in Fig. 3 to form a laminated spring without effect on its action as a beam or spring. A laminated spring so formed is uniformly stressed throughout, and if made with circular curvature, the curvature under deflection will, due to the uniformity of stress on all sections, remain circular but of increasing radius until pressed flat, the blades only touching each other at the tips. This statement requires a little modification, as on account of the thickness the radius at the back is greater than that at the front by the thickness of the blade, so that when "nipped" up there is, at the free position, a small positive stress in the shorter plates and a small negative stress in the longer plates, but this effect diminishes with loading until, when flat, all the blades are stressed uniformly.

The behavior of a spring as a component part of a suspension depends on a number of external factors, all of which affect the smoothness of riding of the vehicle. The ideal to be aimed at is that while the wheels will follow the inaccuracies in their tracks on the road, and maintain uniform adhesion, the sprung portions of the vehicles will float along without vertical movement, rolling or pitching. This ideal is not attained, and in practice all three movements occur; it is therefore the object of the designer so to proportion the parts that road irregularities will cause as little disturbance as possible, and to reduce the more objectionable disturbances to the greatest extent possible, even at the expense of some increase in the less objectionable ones. To avoid temporary separation between the vehicle and the load (in the case of a passenger vehicle, the passengers involuntarily leaving their seats), it is necessary to insure that the vertical acceleration of that portion of the vehicle carrying the load shall never exceed that due to gravity.

Vertical Acceleration

The vertical acceleration depends on the periodicity and the amplitude of the suspension. The former is a function of the design of the spring or springs, and the latter is governed by the magnitude of the external forces imposed on the suspension, and principally arises from the wheels passing over obstructions. The amplitude is therefore in reality outside the designer's control, but he can assess it for the conditions likely to be encountered.

Amplitude in itself is not an objectionable feature provided that the maximum acceleration is less than that due to gravity, and in practice it is found that this value is seldom exceeded if the periodicity of the suspension is 90 complete oscillations per minute, represented by an initial static deflection of the mass of 4.4 in., on a spring with a "straight line" load deflection curve.

Periodicities lower than this are preferable from the point of view of period of oscillation *per se*, and as regards the resulting increased amplitude, not objectionable except for the difficulties introduced in connection with mudguard clearance, ground clearance, and universal joint action. Too low a periodicity has, however, one very objectionable and little expected effect, namely, the reduction of the continuity of the adhesion between the wheel and the road. The adhesion that will cause slip or spin, either intermittent or continuous, for a given road wheel torque is determined, on all but a perfect road surface, by the periodicity of the wheels and the axle as between the elastic tire and the spring, and a lower suspension period reduces the wheel period, lessens the adhesion and consequently conduces to wheel slip.

Nomenclature

The existing nomenclature as applied to laminated springs is not very definite and varies in different shops and districts. The nomenclature and symbols preferred by the author and adopted for the purpose of this paper are shown in Fig. 4.

The word "camber" is commonly used in several ways, but the author confines its use to reference to the actual curve of a blade, and prefers to use the word "height" to define the vertical distance from the bed to the center of the eye of a complete spring.

The term "flat" is frequently used and varies in definition. The author understands that when a spring is loaded till it is "flat" the flatness refers to the main blade, and that a spring when flat is as shown at *A*, Fig. 5, not as at *B*.

The usual beam formulæ put in suitable form for making calculations on laminated springs, together with some convenient tables, are given in Appendix I.

Determination of Stress from Strain in Bending

Strain is the distortion, and the ratio of stress to strain within the elastic limit, where strain is assumed to be proportional to stress, is termed the "modulus of elasticity," or Young's Modulus. For steel in tension this is found to be an approximately constant quantity whatever the intensity of the load or the quality, composition or state of the steel, and can be assumed to be 27,500,000 in lb.-in. units. A representative stress/strain diagram to an exaggerated scale is shown at *A* in Fig. 6.

When a plate is bent, the outer side is stretched and the inner side contracted, one line within the material, the "neutral axis," being neither stretched nor contracted; this, for the present purpose, may be considered to lie at the mid-thickness of the plate.

Let us assume that a plate of rectangular section of uniform width and uniform thickness is to be bent to a complete circle as shown at *B*, Fig. 6. The dotted circle is the neutral axis and has length $2 \pi r$. The outside will have length $2 \pi r + \pi t$, and similarly the inside will have length $2 \pi r - \pi t$. The total extension (elastic extension assumed) or strain of the metal i will depend on the thickness, length and radius, or camber, of the plate, and, by using an approximation, substituting the length of the half-chord for the arc as shown at *C*, Fig. 6, will be found to be $4dt/l$, the stress f to be Ei/l, or by substitution $(E \times 4dt)/l^2$.

This applies to all beams having uniform bending and within the limits of the approximation is correct for perfectly elastic material uniformly stressed; it therefore holds good for a beam of uniform thickness with rhomboidal plan loaded at the center, as well as for the usual case of a beam of uniform thickness and width uniformly loaded, but is not applicable to a rectangular section beam loaded at the center, or any irregularly strained beam, for example, a laminated spring that is not in conformity with the "rhombus" law.

Weight and Reliability

The suspension is one of the heaviest sections of a chassis, and a set of suspension springs frequently totals 200 lb. in a chassis weighing between 2250 and 2750 lb. It is greatly to the designer's interest, therefore, to reduce the weight of the springs, if it can be done without reducing their effectiveness or reliability. The effectiveness depends primarily on the rate of deflection and the reliability on the maximum stress at the most highly stressed point.

The reliability of the spring must not be judged by the amount of metal in it, as this may only be a measure of its inefficiency, and if the stress distribution is irregular the surplus metal may actually reduce the reliability by causing local overstressing, which would not occur if the strain were more evenly distributed.

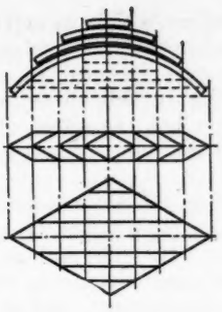
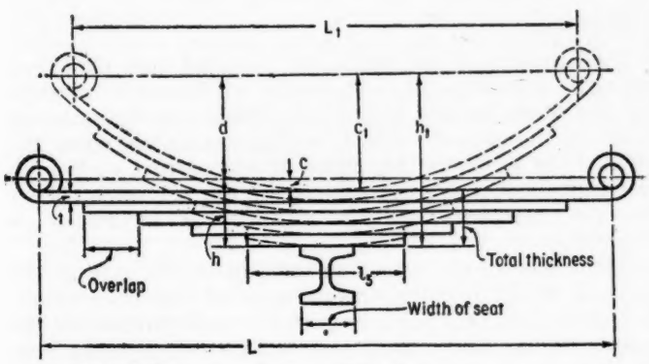


FIG. 3.—Laminated spring with rhomboidal plan.



Length (loaded)	L	Breadth	b
Thickness of blade	t	Load	W
Length (light)	L_1	Max. safe load	W_1
Camber light	c_1	Modulus of elasticity	E
Camber loaded	c	Stress	f
Height light	h_1	No. of oscillations per min.	P
Height loaded	h	Time of one oscillation	S
Length flat	l	Rate of deflection	D
Deflection	d	Total thickness	T
Overlap	o	Weight of Spring	w
$d = c_1 - c = h_1 - h$		Gravity 32·2	g

Blades are designated by number, the main blade being No. 1. Thus in the 5-blade spring shown, the length of the shortest blade is l_5.

FIG. 4.

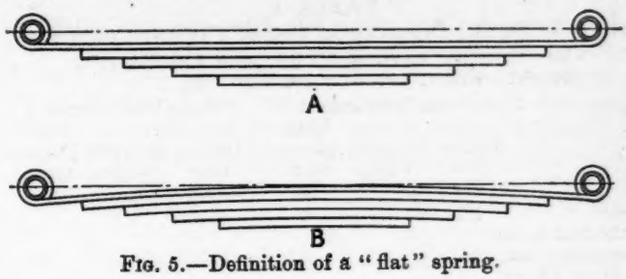
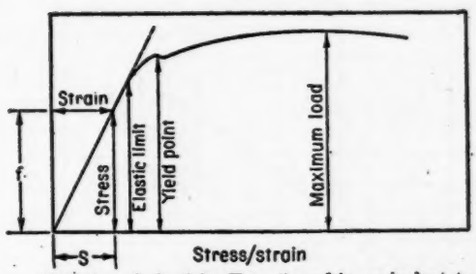


FIG. 5.—Definition of a "flat" spring.



Modulus of elasticity E = f/s and is equivalent to the stress that would produce unity extension (i.e., double the original length of the specimen) if strain remained proportional to stress.

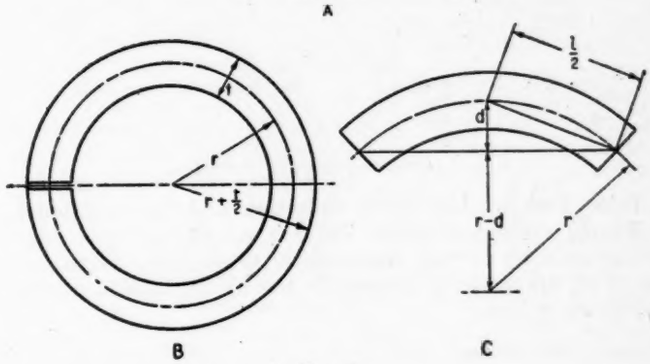


FIG. 6.

The index to the weight of a spring and the best basis for comparison of weights is the volume of the primary rhombus, which is—

$$(lbnt)/2$$

or, as $nt = T$, if based on the full thickness of the spring—

$$(lbT)/2$$

To obtain the actual weight of the complete spring, this must be multiplied by the weight of unit volume and additions made for the eyes and clips and for the excess over rhombus weight, as the main blade is full width throughout, and also if the second blade is full length.

For springs as ordinarily made, including allowance for clips and bushes and one full length blade in addition to the eye blade, the total finished weight varies between 1.45 and 1.55 of the rhombus weight.

Strength, Stiffness and Resilience

The strength of a spring refers to the safe load it will carry, while the stiffness refers to the amount it deflects from the free position either at a specified load or at the maximum permissible load. Resilience refers to the work stored in a deflected spring.

Rankine shows (1) that the strengths of similar beams are directly as their widths and the square of their depths and inversely as their lengths; (2) that the deflections of similar beams under equal loads are as the cubes of their lengths and inversely as their breadths and the cubes of their depths; (3) that the resilience of a beam is half the product of the deflection and the static load producing that deflection.

The formulæ expressing the above statements are:

$$\text{Strength} \ldots\ldots f = [(WL)/(bt^2)] \times C$$
$$\text{Deflection} \ldots\ldots d = [(WL^3)/(Ebt^3)] \times C$$
$$\text{Resilience} \ldots\ldots i = (dW)/2$$

C is a constant which varies for the section of beam and the method of support.

Ratio Between Static and Maximum Stress

The deflection of a spring under an imposed static load is easily predetermined or measured, but the amount which the spring is going to deflect beyond this point in service depends on a number of external, indeterminate factors. Apart from possible artificial mechanical limits, the limitation is the amount of discomfort that will be tolerated by the "load" under adverse conditions.

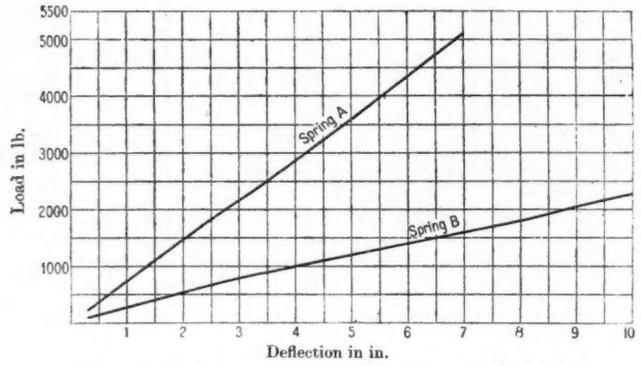
The author has made tests on the road with a device for recording spring deflection, and finds that with normal suspension it is necessary to provide, both as regards clearance and stress considerations, for total deflection on the rear springs of from one and three-quarters to twice the static deflection, and on the front springs of from two and a half to three times the static deflection. Since the front springs are stiffer than the rear springs, the deflections will be of less magnitude, and consequently the maximum deflection will usually be less than the maximum rear deflection.

TABLE I

TABLE OF SPRING DEFLECTIONS UNDER VARYING CONDITIONS

Car—4-seater, nominal 20 hp. with 4 passengers.
Weight—Front, 16 cwt.; rear, 20 cwt.

	Front Suspension			Rear Suspension		
	Deflection in.	Relative Value	Displacement in.	Deflection in.	Relative Value	Displacement in.
Static	1.2	1.0	0	4.7	1.0	0
At 20 m.p.h. on smooth road.	1.7	1.4	0.5	6.1	1.3	1.4
At 20 m.p.h. on rough road..	2.4	1.8	1.2	7.0	1.5	2.3
Driven off a 4½-in. curb at 30 m.p.h..	3.2	2.8	2.0	9.4*	2.0	4.7



Spring A. Chromium steel. 37 in. long. 2 in. wide. 8 blades.

Spring B. Chromium steel. 52 in. long. 2 in. wide. 9 blades.

FIG. 7.—Deflection curves of springs.

Table I shows the static deflection and the additional deflection measured under varying conditions in a particular case of normal semi-elliptic suspension, as an example of the methods adopted in the determination of the foregoing values.

Permissible Stress

The permissible static stress for a rear spring is therefore from 0.5 to 0.6 the maximum safe stress, and for a front spring from 0.3 to 0.4 the maximum safe stress.

The maximum safe stress can approach the point at which permanent set takes place, and the author finds from experience on cars under working conditions and from over-stressing actual springs in a testing machine that the following figures are practicable:

Minimum tensile breaking strength—

Carbon steel, 80 tons per sq. in.
Alloy steel, 90 tons per sq. in.

Maximum safe stress—

Carbon steel, 50 tons per sq. in.
Alloy steel, 65 tons per sq. in.

Maximum permissible normal static stress—

Carbon steel, front springs, 20 tons per sq. in.
Carbon steel, rear springs, 30 tons per sq. in.
Alloy steel, front springs, 24 tons per sq. in.
Alloy steel, rear springs, 36 tons per sq. in.

These stresses are calculated on the formula:

$$f = (6WL)/(4bt^2)$$

The working stresses appear high in relation to the breaking strength of the material, but it must be remembered that they are calculated by the ordinary beam formula which gives values which in extreme cases are possibly 50 per cent higher than the real stress, and also that the laminated spring is stressed in one direction only, and the over-stressing in this direction during the first "scragging" operation has the effect of raising the point at which permanent set takes place when the spring is re-stressed.

A schedule showing a few examples of the stresses adopted in various springs taken from current practice is given in Appendix III. The values given as maxima are for properly designed springs in which the stress is reasonably uniform throughout, and if it is required to apply them to springs in which the ratio between maximum stress and mean stress is not negligible, due allowance must be made.

Flexibility

The property of the steel that is called into play in a spring is its ability to bend, which is effected by stretching the fibers on one side of the blade and compressing those on the opposite side to an approximately equal extent. It is probable that little, if any, actual stretching or compression takes place, most of the movement being due to alteration in form rather than alteration in volume.

When springs are loaded so that the strain exceeds the limit of proportionality, the modulus of elasticity alters, and while it is probably constant for a given material for any particular fiber stress, and variations below the elastic limit are so small as to be negligible for the present purpose, it is not the same at all fiber stresses.

Deflection

The deflection of a spring within the elastic limit follows exactly the same laws as a beam. The deflection is proportional to the load and is expressed by the formula:

$$d = (WL_s)/(4bED^3)$$

For the case of a laminated spring nt is conveniently substituted for the depth of the beam D, when the formula becomes:

$$d = (WL_s)/(4bEnt^3)$$

The length of a cambered spring changes with alteration in load, so that although the spring theoretically follows a straight line law for load deflection, in practice, due to this length alteration, the load deflection curve may not be quite a straight line. For this reason it is usual for the rate of deflection of a spring to be defined by dividing the normal load by the deflection at normal load.

Typical load deflection curves are shown in Fig. 7, where the particulars of the springs tested are given in detail.

Departure of the load deflection curve from a straight line, due to change in length with change in camber, has been taken advantage of to secure a variable rate of deflection, but the resulting high cambered spring is objectionable and the riding is not so smooth as that obtained from a flat spring that articulates on each side of the flat position.

TABLE II

TABLE OF SPRING DEFLECTIONS AND PERIODICITIES**

Deflection in in.	Periodicity Complete Oscillations Per Minute	Deflection in in.	Periodicity Complete Oscillations Per Minute
39.1	30	2.5	120
14.1	50	2.1	130
9.8	60	1.8	140
7.2	70	1.5	150
5.5	80	1.35	160
4.4	90	1.2	170
3.5	100	1.1	180
2.9	110		

*Limit of clearance.

**See also table given by Dr. F. W. Lanchester, Proc. I. A. E., Vol. II, p. 192.

In automobile practice, where springs are practically flat in the loaded position, it is usual and sufficiently accurate to take the straight or sector length as the value of L both in the strength and in the deflection formula. In this latter formula, where L^3 is the expression, one L is the sector length derived from the bending moment WL, while the other two L's represent the curved length of the blade. The use of the sector L only, the smaller of the factors, introduces an inaccuracy which approximately compensates for the fact that the value t in the expressions bt^2 and bt^3 is conveniently taken as the normal thickness of the plate, which is greater than the actual mean thickness on account of the concavity.

The tendency of these inaccuracies to balance one another does not make a satisfactory arrangement from the mathematical point of view, and would introduce serious inaccuracies in calculations for any but approximately flat springs made of blades of commercial dimensions, and, therefore, the use of the simple formulæ given must not be extended to general applications without having appropriate corrections applied.

Periodicity

The rate of oscillation of a spring suspended system is dependent on gravity, and follows the same general laws as the pendulum and the governor. The basic formula for expressing the time of an oscillation is $t = \pi\sqrt{l/g}$, where t is the time of one oscillation and l is the deflection, which is the amount by which the spring is deflected statically by the load under the action of gravity from its free position. This formula is only strictly applicable to theoretical conditions, represented by infinitely small oscillations of a frictionless spring in a vacuum, but the modifications to represent actual practice are small, and may be neglected. The formula ignores amplitude, and within the limits of laminated suspension springs amplitude makes little alteration to the periodicity, its principal effect being to modify the friction effect.

For spring calculations, the formula can be more conveniently expressed in inch-minute units as $P^2 = 35230/d$, P being the number of complete oscillations per minute and d the static deflection.

The relation between the rate of oscillation and the amount of deflection calculated from this formula is shown in Table II and graphically in Fig. 8, from which particulars the comparatively close practicable limitations of suspension period can readily be seen, these being at the one end excessive deflection and at the other extremely rapid oscillation.

The periodicity of a spring can be readily measured to a considerable degree of accuracy by means of a device such as that shown in Fig. 9. Representative diagrams taken with an apparatus of this type are shown in Fig. 10, and these give some idea of the way in which the spring oscillations die out due to friction when the exciting cause is removed.

Periodicity of a Suspension

The periodicity of a suspension has to be considered as a whole, as all portions act in unison to produce a resultant, and the separate components cannot oscillate independently of each other.

A suspension has different natural periods in the several planes, normally one period only for each plane. In the case of a motor car, these can be divided into:

1. The front suspension vertical period.
2. The rear suspension vertical period.
3. The rolling period.
4. The pitching period.

Each of these will be different, and furthermore it will be found that the rear and front springs interact, and that, for example, the rear vertical period will be slower if the front springs are free than if they are locked, as the movement of the free front spring alters the amplitude of the mass and so modifies the time of swing to an extent that depends upon the weight distribution and other variables.

The rolling period and the pitching period both result from the combined action of all the springs, front and rear. The former is largely influenced by the height of the center of gravity above the suspension level, and is usually considerably slower than either of the vertical periods, while the latter depends on wheelbase and weight distribution longitudinally.

The difference between the rolling and the rear vertical periods and the small practical range of periodicity constitute the principal disadvantages of normal suspension systems and indicate the most promising directions in which to seek for improvement.

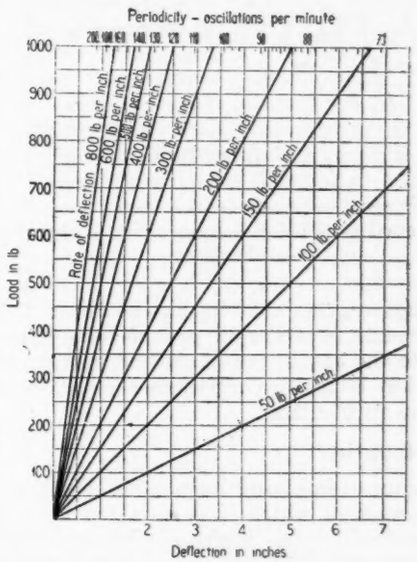


FIG. 8.—Relationship between load, deflection and period.

Internal Friction

The effect of friction between the leaves is to damp out the oscillations gradually as is seen by the graphs shown in Fig. 10 already referred to. This effect has been investigated by Mr. G. H. Baillie,* who tested springs with varying amounts of internal friction and also ascertained experimentally the effect of frictional shock absorbers.

The amount of friction in a laminated spring as ordinarily made is small, but is useful in damping out oscillations more quickly than would otherwise be the case. It is doubtful if any considerable increase of friction, either by a modification of spring design or by the addition of shock absorbers, is desirable except in extreme cases, such as on racing machines, where wheel adhesion and ability to hold the road take precedence over comfort.

Resistance to Torsion

Laminated springs present considerable resistance to torsion, especially when under load, due to the lessened tendency for the leaves to separate, and this resistance, on account of the methods of mounting adopted, stiffens the usual forms of suspension in their resistance to rolling. In this respect the semi-elliptic spring is superior to the cantilever, as both ends of the former are effective, and as the greatest possible resistance to rolling is desirable, this lessened torsional resistance may be considered a defect of all simple cantilever suspensions.

*See Proc. I. A. E., Vol. VII, p. 451.

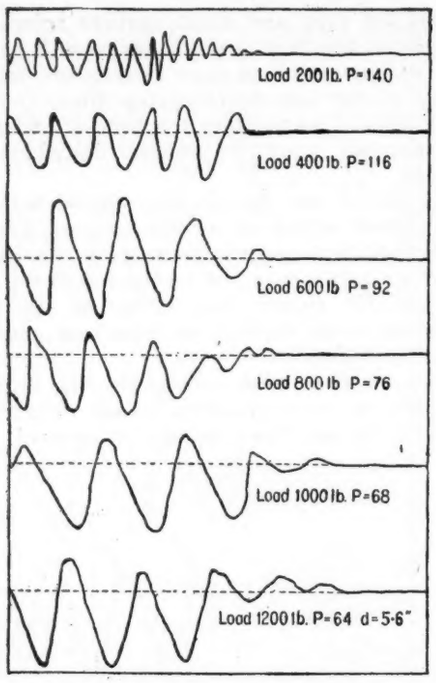


FIG. 10.—Actual periodicity diagrams from a 52 in. by 2 in. 9-blade spring.

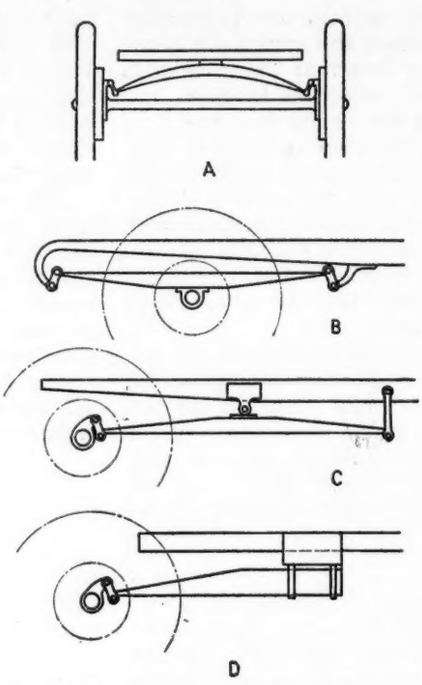


FIG. 11.—Forms of suspension.

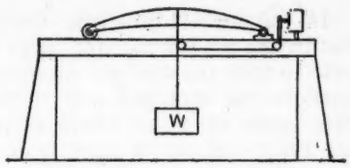


FIG. 9.—Periodicity machine.

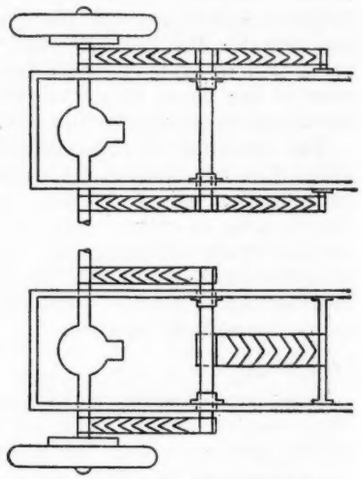


FIG. 12.—Anti-rolling suspension.

The author regrets that he has not been able to carry out experiments in order to provide quantitative results in regard to the resistance of normal springs to torsional deflection, but hopes to contribute some data on the subject at some future time.

Effect of Mounting

Other factors remaining unchanged, the type of spring and the manner in which it is mounted have little effect on the suspension. The method of fixing or pivoting the springs on the frame affects the resulting action, but only in so far as it modifies the degree of freedom or direction of articulation of the parts.

The usual forms of normal rear suspension can be expressed by four groups, as shown in Fig. 11.

(a) A transverse spring fixed to the frame at the center and linked to the axle at each end.

(b) Two semi-elliptic springs, one at each side, pivoted to the axle at the center and linked to the frame at each end.

(c) Two cantilever springs, each linked to the axle at one end, linked to the frame at the other, and pivoted on the frame at the center.

(d) Two half-cantilever springs linked to the axle at one end and fixed to the frame at the other.

These four forms of suspension make no difference to the external effect provided that the rate of deflection is the same, and that the axle is articulated in respect to the frame in the same manner, but they only modify the internal effect, particularly as regards the stresses and stress distribution in the various members.

Articulation of, or interconnection between, the various springs, by altering the degree of freedom, affects the suspension, usually more particularly in the direction of degree of stability; for example, if in the case of group (a) the spring were pivoted on the frame at the center, instead of being fixed to it the suspension would lose all lateral stability, or resistance to rolling; and if in group (c) the springs, instead of being independently pivoted on the frame, were interconnected at their centers by a shaft fixed to each of them and carried in bearings on the frame as shown in Fig. 12, the suspension would not be altered as regards vertical movement but would have enhanced resistance to rolling. This latter arrangement is covered by patents taken out by the author and in use by Messrs. Wolseley Motors, Ltd.

The primary rhombus is equally and similarly stressed on every section, as shown in Fig. 13 at *A*, where

$$WL = f(bt^2/6)$$

Also, a laminated spring conforming to the rhombus law is in a similar condition, as shown at *B*, where

$$WL = f(bnt^2/6)$$
$$Wl = f(bt^2/6)$$
$$Wnl = f(bnt^2/6) = WL$$

Each blade, except the shortest, is loaded in a similar manner, as shown at *C*, where again

$$WL = f(bt^2/6)$$

the bending moment being proportional to the section throughout, and constant where the section is uniform. The fiber stress on every section being the same, the load on the tip of each blade must also be the same and is the load carried by the spring, the maximum bending moment being proportional to the number of blades, *i. e.*, to the number of sections into which the rhombus is divided.

Departure from Primary Rhombus

When the primary rhombus is departed from, or the blades are cambered to differed radii, the uniformity of stress distribution disappears, and the effect of such departures can be foreseen. For example:

1. Full width instead of spear-shaped blades will increase the bending moment and the fiber stress on the short blade, and reduce the stress on the other blades.
2. Overlength blades will have the same result.
3. "Nip" will have the same result.
4. "Grading" without "nip" will reduce the stress in the shorter blades and increase it in the longer blades.
5. Additional full length blades will have the same effect as overlength blades.

A spring proportioned according to the rhombus law is shown in Fig. 14 at *A*, and one with overlength blades at

B. If truly cambered to a circular curve, the overlength blades will bend irregularly, due to the irregularity of stress, and will not remain in contact when the spring is loaded. "Nip" seriously affects the stress distribution, but has little effect on the load-deflection curve. At *D*, Fig. 15, a three-blade spring with all full-length blades is shown. If this spring is made without "nip," the stress in each blade will be the same when it is loaded, but if a second spring is made with "nip" as shown at *C*, although the nipped up springs will appear identical, and the load deflection curve within the elastic limit will be the same, the stress distribution will be entirely different.

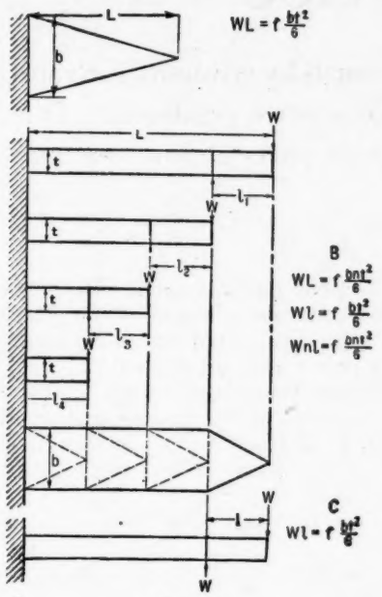


FIG. 13.

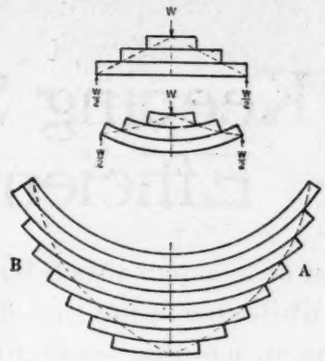


FIG 14.

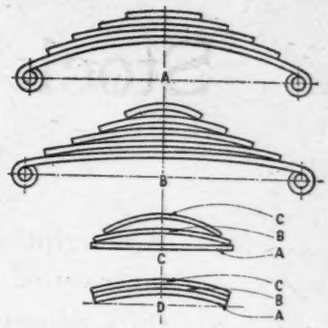


FIG. 15.

Taking the proportions shown, when pressed flat the lower blade of the spring with "nip" will not be stressed at all, and the whole of the stress that would be carried by it if the spring were made without "nip" will be carried by the topmost blade, which will thereby be stressed to twice the amount to which it would be if the spring were made without "nip." Therefore, in this particular extreme case, the maximum stress in the spring with "nip" will be twice the mean stress, and while the load deflection curves will be identical, the maximum safe load for the one spring will be only half that for the other.

A Foreign Book on Fuel and Lubricants

BOOKS intended for both scientists and laymen, as a rule, are not very practical because they will either be above the heads of the latter or else of no use to the scientist or engineer. Dr. J. Formanek, Professor at the Bohemian Technical High School at Prague, has, however, written a thoroughly practical manual. This book, entitled "Benzine and Mineral Lubricants," has been translated from the German by Charles Salter and is being published by Scott, Greenwood & Son. D. Van Nostrand Co. is the American agent.

The "benzine" with which this book deals is really gasoline, and it is hard to understand why the translator did not choose the word petrol instead of benzine. The book is addressed on the one hand to automobile owners, owners of internal combustion engines, automobile engineers and all who have to do with the testing of fuels and oils, and, on the other hand, to chemists who are called upon to report on motor fuels and lubricants. Owing to this double purpose the author has endeavored to keep down the size of the work.

The average automobile owner in this country may not be particularly interested in the chemistry, production and scientific testing of gasoline and other motor fuels, but in judging this phase of the author's appeal the fact must be taken into account that it was originally written during the war period in one of the Central Empires at a time when getting fuel for a car was not merely a matter of driving a block or two to the nearest filling station, but when practically any liquid that would serve as fuel in internal combustion engines was given a trial. It is not hard to understand that under those conditions private owners of motor vehicles were willing to go somewhat more extensively into the science of motor fuels than the average automobile owner in this country to-day.

The book will probably be of particular interest to petroleum chemists, as it deals chiefly with the methods in use in the Galician oil fields and the refineries supplied by them. It should, however, also prove of interest to the automobile engineer, in view of the constantly changing character of our fuel and the many problems raised thereby. It deals especially comprehensively with testing methods. The following list of chapters will give a good idea of the field covered: Petroleum, Its Composition and Treatment; Coal Tar Products; Brown Coal, Shale and Peat Tar Products; Products from Petroleum and Tar Residues; Testing Benzine and Benzol; Judging the Quality of Benzine and Benzol; Testing Mineral Lubricating Oils; Judging Mineral Lubricating Oils; Properties and Uses of Fuels; The Consumption and Efficiency of Various Fuels in Internal Combustion Engines; Suggested Improvements in Motor Car Equipment; Safe Storage of Benzine and Benzol; First Aid in Cases of Gassing with Benzine.

AMONG other conclusions, in a monograph "China: Automotive Conditions and Good Roads Movement," the author, J. Morgan Clements, American Trade Commissioner, states that although China's increasing interest in road building is an encouraging sign, American manufacturers should by no means jump at the conclusion that an immediate market will be created for large numbers of motor cars and trucks.

This monograph may be obtained on application to the Automotive Division, Bureau of Foreign and Domestic Commerce, Washington, D. C.

Stock Keeping System an Aid to Efficient Service

A description of a system which has proved its worth by reducing the capital invested while increasing the efficiency of the service rendered. This stock department handles yearly a large volume of parts at low expense.

By Philip H. Smith

THE ever-increasing importance of service and the stress laid upon it brings to the fore the value of efficient stock handling. The problem of service is the sum total of the problems of the repair and stock departments. To the degree that the problem of handling stock is solved, so also the problem of giving service in an efficient manner will approach a solution. An efficient stock system has a definite service value.

The primary object of a stock department should be to supply necessary parts on demand at all times, without friction and with the least possible expense to the company. The ability to supply parts on demand determines the efficiency of the department's service. The problem lies in getting the proper balance between the ability to supply parts and the minimizing of expenditure; neither must be achieved at the expense of the other.

Because it is carrying approximately 22,000 different parts, and because it is supplying parts to cars and trucks even as far back as of the vintage of 1907 with an efficiency claimed to be as high as 98.7 per cent, the Parts Department of the Long Island City Service Station of the Packard Motor Car Company of New York deserves attention, and anything that may be written about it cannot fail to furnish something of a worth-while nature to those who are trying to solve the stock handling end of the servicing problem.

This stock department furnishes parts to seven branches and 29 dealers located in the states of New York, New Jersey, Connecticut and Massachusetts. The department itself occupies one large floor, which carries the main supply, and there are sub-stock rooms located in the car repair, truck repair and coach shop.

Stock is divided into three groups: Active, excess and surplus. Definitions of the groups and approximate percentage of the total stock carried in each group are:

1. Active—parts with a turnover within one year, 94 per cent.
2. Excess—parts which turn over in one to four years, 3 per cent.
3. Surplus—parts which turn over in four years or over, 2 per cent.

The advantages of this grouping are that active parts do not depreciate because they have numerous turnovers within a year, and that the value of inactive parts is really increased due to ready sale through centralization.

Of the active stock, approximately 85 per cent is carried in the main stock and 5 per cent in each of the sub-stocks. This supply of parts in the sub-stocks fills about 80 per cent of the requirements of the respective shops. In general, they carry the light and medium weight parts only, and the heavy parts are kept in the main stock. All the excess and surplus stock is carried in the main stock room and no effort is made to replace it when it is depleted. It serves only as a convenience to drivers of very old cars.

Stock bins are built in sections, each section bearing a letter. Parts are kept in units as far as possible; thus, for example, all clutch parts would go in one section. This arrangement has reduced the force by one man, because each sale is usually comprised of several parts for one unit. The individual bins are filled according to piece number sequence and run from top to bottom and from left to right of section. Besides bearing a tag with the piece number and name of part, each bin has a separate bin number.

A master file, containing a card for every part carried, is located near the stock bins. Each card bears the name, piece number, bin location and section, and is filed numerically according to piece number. Other special cards such as Discontinued Assembly (Fig. 4), Obsolete Part (Fig. 5) and Part Not Stocked (Fig. 6) are filed numerically within the master file in the same manner. The discontinued assembly card shows an assembly now carried as separate parts. It

PIECE No. | NAME | DANGER LIMIT

PLUS M.T. | LIST | COST | DATE | MAIN STOCK | SUB STOCK

BASE | 1ST | 4TH | 5TH

SECT. | BIN | CARD No.

ORDERED						RECEIVED AND DISBURSED							
DATE	ORDER No.	AMT.	REC'D	BAL. DUE	MAIL ORDER	DATE	ORDER No.	AMT.	BAL.	DATE	ORDER No.	AMT.	BAL.

Fig. 2—Parts order

facilitates making up an assembly, when so desired, by listing the piece numbers, names, amount used and location of all the component parts. The obsolete part card advises the piece number, name and location of the superseding part. The parts not stocked card gives piece number, name and reason for not stocking. This master file serves to give to the employees all information regarding parts and their location.

Stock Record System

The key to the entire stock keeping system is the stock record card, and it is essential that this be understood before going on to describe the system. Every part stocked by the stock department has its own record card (Fig. 1), which is kept in the stock record office. This card contains the following information regarding the part: Piece number, name of part, location in bin, list and cost price, columns for all information regarding ordering, receiving and disbursement and main and substock room danger limits. A danger limit is a predetermined figure showing the lowest amount of each part that can be carried safely. When the balance of parts on hand bears the same figure as the danger limit, the record clerk attaches a red tag to the card. This danger limit is determined by the length of time that it takes to obtain shipments from the factory, which varies from two to four weeks, according to whether the material comes by express or freight.

The installation of a danger limit insures getting parts before the supply runs out and eliminates guesswork in ordering.

The same system of recording stock is used for parts stocked in the sub-stock rooms. In the recording office a separate file is kept for each sub-stock room and in each file is a record card for every part stocked. The method used in keeping this record card file will be dealt with as the various factors connected with it are outlined.

Ordering

All parts, whether coming from the factory or locally, are ordered by the order clerk. Very few parts are purchased locally, but the system is the same in any case. The order clerk collects the red-tagged record cards daily and immediately makes out an order from them in duplicate (Fig. 2). This order shows the quantity ordered, piece number, name of part, bin number and location in stock room and a place for the factory invoice number. The original copy is forwarded to the factory and the duplicate to the invoice clerk. Every effort is made to order in such a way that parts are brought through in carload lots. This brings shipments faster than broken carload lots and practically secures express service at freight rates. As each part is ordered it is entered on the stock record card with the following information: Date of ordering, order number and quantity ordered.

Receiving

When parts are received from the factory they are immediately unpacked in the receiving room. A tally sheet accompanies the shipment, which is a carbon copy of the factory invoice to Long Island. The tally sheet is forwarded to the invoice clerk, who fills in the bin location which is obtained from the factory order, at the same time checking it against the factory order for quantity received, change in piece numbers and prices. To indicate a change in piece numbers a card (Fig. 3) is used which is filed in the master file in the main stock room. In this way any superseded piece numbers will be caught and new record cards installed before the parts are placed in the bins. After this is done, the tally sheet is returned to the receiving clerk, who checks in the parts, inspects and verifies the quantities as shown on the tally sheet. Parts are then put away, using the bin location furnished on the tally sheet.

When stock is received, the following information is entered for each part on its respective record card: Order number (in red), quantity actually received, balance due, if any, and factory mail order number on which the parts arrived. The mail order number and quantity received is then copied on the disbursement side of the record card, showing the new balance.

Disbursement

There are three distinct divisions in the disbursement of stock. In order to show how this part of the work is handled, each division will be taken one at a time.

The crew of men who disburse parts from the sub-stock rooms began in the department by receiving and checking in, and in that way have become acquainted with the different parts, the method of stocking and their location.

Fig. 3 — Change notice card. Fig. 4 — Discontinued assembly card.—Fig. 5—Obsolete part card. Fig. 6—Part not stocked card

As the stock from the sub-stocks is disbursed solely to the shops and hence used for replacement in repair work, every request for a part must appear on a requisition and bear the order number of the job in which it is to be used. The requisition is made out in triplicate, the original and duplicate copies are forwarded to the record office, where they are priced, then the former is sent to the cost department, where it is put in the job order envelopes, the latter remaining in the office. The third copy remains with the requisition writer as his reference.

All requisitions filled from sub-stock are stamped with a rubber stamp indicating it. The requisition is then forwarded to the record office, and from the information thereon the proper disbursement is made on the stock record card. When the supply shown on the record card reaches the danger limit, the record clerk makes out a transfer to replenish the sub-stock from the main stock. This transfer itself is made by the night man. This system has two advantages: the sub-stock man is not engaged in handling records and orders and can devote his entire time to waiting on the shop, and the stock is transferred at night without confusion.

The parts ordered by dealers, branches, mail, telephone and telegraph customers are drawn from the main stock and the proper disbursement entries made on the stock record cards. Stock thus drawn is sent to the shipping department, checked and shipped in the usual way. The men who handle these orders have been promoted from the sub-stock rooms.

Direct customers, the third division, are cared for by a group of men who have been through the entire system and are ready to give expert service as a result of their previous stock experience. Customers' orders are written on cash sale or charge part orders. In the case of cash sales, the order is written in triplicate. All copies are priced and the original and duplicate handed to the customer, who, after paying the cashier and having it stamped, returns the copies. The triplicate is wrapped and delivered with the parts. The original and duplicate are forwarded to the accounting and record office respectively, the latter giving information from which to make the proper disbursement on the record cards. In the case of charge accounts the system is the same, only in place of paying the cashier, the customer has the orders approved by the credit department.

In order to facilitate the handling of parts for large fleet owners who operate in several states, one man handles all these so-called national accounts. His only other duty is to take charge of returned parts. The national accounts man becomes personally acquainted with the representatives and a closer contact is secured by this system.

Branch Stock System

A close supervision is maintained over the branches, and in order to understand the system of stock handling it is well to know that the same record card system is used.

The method of handling stock at the branches used previously to the one about to be described is briefly as follows: Parts were ordered directly from the factory, and there was no absolute limit as to the maximum supply of each part to be kept on hand, this being left largely to the discretion of the branch stock manager.

Difficulties arose from that method for several reasons. In the first place, the tendency was to carry far too much stock, thereby cluttering up the stock room and tying up more capital than was necessary. Also, the stock managers were constantly being bothered by salesmen in an effort to make the branches carry a different line of locally bought stock, such as brake lining, accessories, etc. It meant that the stock managers had to be better buyers than the New York purchasing agent, or the branches would suffer from inferior goods, or goods not up to the standard set by the factory.

A maximum-minimum system is now used and it is required that all parts be ordered directly from the main office at Long Island. The amount of stock necessary for each branch to carry has been determined from three sources, as follows, on a basis of:

1. Sale of parts for the previous three months.
2. Sales for the corresponding three months of the previous year.
3. The number of cars in the locality.

By taking the figures from these three sources and blending them a very accurate figure capable of caring for the increase per year, local and seasonal business, is obtained. Having determined the maximum amount of parts to be stocked, a minimum is set as well as a danger limit determined, the latter being approximately half way between the maximum and minimum figures. Here, again, the danger limit is determined by the length of time that it takes to replenish the supply.

A record file is kept at the Long Island record office, containing a card for every part stocked at the branches. These cards (Fig. 7) are filed numerically according to piece number, each card containing the names of the branches and the maximum, danger limit, and minimum figures for each branch.

When an order comes in from a branch it is possible to tell by a glance at the branch file whether the stock manager has ordered more than enough to reach the maximum, in which case the surplus is not sent, and the man risks losing his position. Of course, stock suddenly depleted below the danger limit must be replenished, but a notation to that effect would accompany the order.

Let us see the advantages accruing from this system. The investment in parts is kept at a minimum and yet good service is assured. The purchasing responsibility rests on one man, who is a specialist. Only active parts are carried and the inactive parts are centralized in the excess and surplus divisions of the main stock room and

not lying fallow at the branches. The flow of parts is facilitated by quantity ordering, as duplication and friction is avoided and better express and freight rates secured.

Assuming that the main office is not able to furnish an exceptionally large order of a certain part, it is possible, knowing the branch minimums, to wire the nearest branches to ship their minimum to the given destination. This brings the branch supply down to the danger limit and immediately an order is sent to the factory to replenish the main and branch stocks. In the meantime the customer has had real service.

In connection with branch stock it would be well to mention that this maximum-minimum system has been carefully worked out and is at the disposal of the company's dealers, if they care to adopt it. Any wide-awake dealer can see the advantage of giving maximum service at minimum cost, and it is also to the advantage of the company, in the long run, to aid the dealer in reducing his capital investment in parts and yet give service as it should be given.

Inventory

The taking of inventories has always been more or less of a nightmare to most concerns, hence any system which removes some of the difficulties has secured a measure of success.

A thorough inventory has been taken in two days and a night. The method consists in filling up the sub-stock supply, closing the main stock for inventory and during that day supplying parts from the sub-stock. After the main stock has been inventoried, all drawing of stock is made from the main stock while the sub-stocks are closed and inventoried.

The taking of an inventory starts with the making up of a bin index (Fig. 8), which is simply sheets of paper with columns of numbers from 0 to 100. These sheets can be expanded indefinitely for each bin section by the mere addition of a numerical suffix to the numerals. Piece numbers are then written on the sheets beside the numbers which correspond to the respective bin numbers. This is done for every bin and acts as a positive check on the stock room. The next step is to write an inventory count card (Fig. 9) for every stock record card in the record office, giving the piece number, name of part and location.

BROOKLYN					
WHITE PLAINS					
NEWARK					
PATERSON					
JERSEY CITY					
HARTFORD					
NEW HAVEN					
NEW LONDON					
SPRINGFIELD					

Fig. 7—Main office branch stock card

This should give a count card for every piece number in the bin index.

Having completed the bin index and inventory count cards, the latter are arranged in numerical sequence (bin number sequence) and according to sections. The cards are then checked against the bin index to check for piece numbers and locations, also to insure having a count card for every piece number. Any stock without a count card

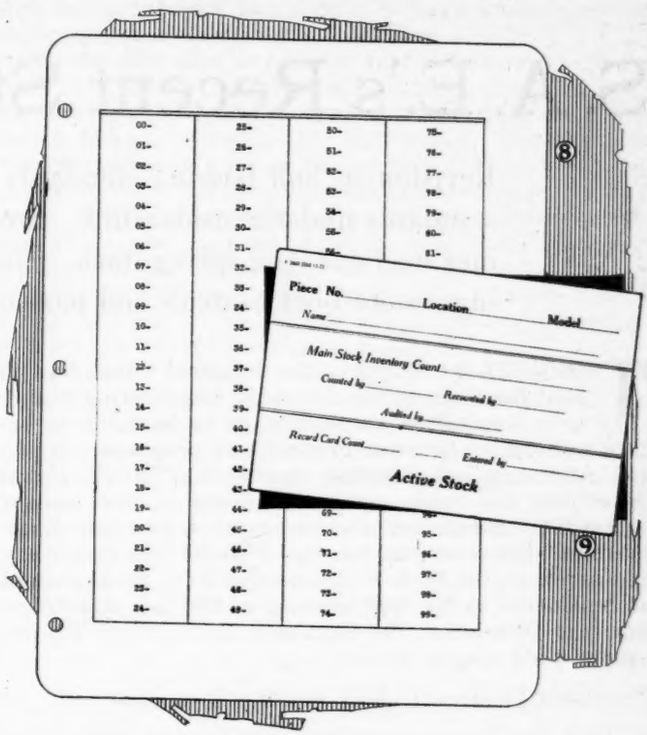


Fig. 8—Bin index sheet. Fig. 9—Inventory count card

shows bad location of stock, misplaced stock record card or a lost count card.

The inventory count cards are placed in their respective bin locations according to bin number and section, or, in other words, in numerical sequence. The parts are counted, recounted by a second man and finally audited by a man from the accounting department, each man initialing card after counting. The cards are then taken out of the bins in their numerical sequence and returned to the record office, where they are checked against the bin index to insure the return of all cards.

The final step is to enter the inventory count from the count cards on to the stock record cards. If there is no discrepancy, the balance on hand on the stock record card and the inventory count on the inventory count card should be identical. Inventory sheets are then made up to show the total inventory.

If the system has been kept up with care during the year there is no reason why there should be a big discrepancy between the actual inventory and the inventory that the books show.

Conclusions

To the question: "Doesn't this system require an abnormally large force to handle all the necessary records properly?" Mr. F. Preston, the manager of the stock department, replied that it requires fewer employees than the average system. In connection with this, the service rendered, investment involved and volume of business should not be forgotten. The present system has resulted in a decreasing of one-third of the capital invested in stock, while the efficiency of the department has steadily increased. This may certainly be said to be traveling in the right direction.

A DESCRIPTIVE Handbook on General Instrument and Oxygen Equipment for aircraft has been issued by the Air Ministry (Directorate of Research) of Great Britain. Copies can be obtained from H.M. Stationery Office, London.

S. A. E.'s Recent Standardization Work

Revision in ball bearing standards to secure agreement with the German standards under consideration. Iron and Steel Division discussing Bessemer steel and wire spring stock. Distributor, magneto and bumper mountings, motorboat controls and passenger car frames considered by divisions.

THROUGH the efforts of the Sectional Committee on Ball Bearings of the American Engineering Standards Committee an attempt is to be made to secure uniformity between present and proposed German and American ball bearing standards. The Sectional Committee has made certain requests to the sponsor bodies for ball bearings, the Society of Automotive Engineers and the American Society of Mechanical Engineers, and as far as the S. A. E. is concerned the requests will be considered at the next meeting of the Ball and Roller Bearings Division of the Standards Committee. The requests made are as follows:

Requested Changes in Ball Bearing Standards

"That the Society investigate the German extra light series of ball bearings and give careful consideration to the advisability of establishing a corresponding S. A. E. standard.

"That the society make a careful study of the proposed German light series extra large standard, and if possible change the outside diameter for the corresponding S. A. E. standard to agree with the outside diameters adopted by the German Standards Committee; and that the widths adopted by the German Committee should be thoroughly considered. The Sectional Committee believes, however, that the narrow widths will not permit satisfactory design of radial bearings carrying an appreciable thrust-load and that they are not suitable for the design of double-row ball bearings with spherical outer races.

"That the Society make a careful study of the proposed German medium series extra large standard, and if possible change the outside diameters of the present S. A. E. standard to agree with the outside diameters adopted by the German Standards Committee.

"That the Society make a careful study of the proposed German heavy series standard and change the outside diameters for S. A. E. bearings above 85 mm. bore of the heavy series to agree with the outside diameters adopted by the German Standards Committee.

"That the Society consider (a) changing the outside diameters of the light, medium and heavy series double-row bearings to conform with such outside diameters as are finally adopted for the single-row bearings; (b) changing the S. A. E. Standard to bring the widths of the S. A. E. and German standards together, or to change the inch widths to millimeters; (c) investigating the possibility of a demand in America for a narrower series of double-row ball bearings than the present S. A. E. Standard.

"That the Society consider changing the S. A. E. Standards so that they will conform with the corner radii adopted by the German Standards Committee, particularly in view of the fact that it is stated that the S. A. E. corner radii are too small.

"That the Society consider the German standard width-tolerances and indicate what recommendation should be made for standard width-tolerances in American practice, as well as what would be the result in America if the closer German tolerances were adopted."

In connection with the size standards the Sectional Committee suggests that in studying the possible change of outside diameters the Society endeavor to omit some of the intermediate sizes, particularly in the heavy series, and that the outside diameters of the series be selected so that as few outside diameters as possible are necessary, to reduce the necessary tool equipment.

In the present S. A. E. Standard for distributor mountings it is specified that the distance from the base of the distributor body to the end of the coupling tongue shall vary to suit conditions. It had been suggested that this dimension be standardized, and a subdivision of the Electrical Equipment Division consisting of W. A. Chryst has now recommended that the following revisions be made:

(1) Specify a dimension of 27/32 in. for the distance from the base of the distributor body to the end of the coupling tongue of the Type-B ignition-distributor.

(2) Change the limits for the bore of the collar from 0.4930 in. maximum and 0.4920 in. minimum to 0.4915 in. maximum and 0.4905 in. minimum.

The dimension of 27/32 in. is in accord with present practice. The revision in limits does not affect the actual manufacturing tolerances now specified for each part, but results in closer fits, 0.0020 in. maximum and 0.0005 in. minimum instead of 0.0035 in. maximum and 0.0020 in. minimum, between the collar and the shaft. As it is thought that the fit of the tongue and the groove is more important than that of the collar and the shaft because there is more wear between the former than between the latter, no revisions of the present limits are recommended.

Passenger-Car Bumpers

In 1921 a questionnaire was sent to passenger-car builders as to the feasibility of standardizing a plain bolted-on connection for passenger cars using the conventional type of pressed-steel frame. Although it was pointed out that the adoption of such a standard would necessitate providing holes in the passenger-car frame in conformity with whatever standard was proposed, these holes to be used either by the passenger-car builders for mounting bumpers as standard equipment or by the owners for mounting bumpers as accessories, over 90 per cent of manufacturers replying to the questionnaire recommended the formulation of such a standard bumper-mounting.

A Subdivision, consisting of F. G. Whittington and E. W. Weaver, appointed for the purpose, has recently made the recommendation given in the accompanying figure:

Two 33/64-in. diameter bolt holes shall be located on or near the neutral axis of the frame section.

The first bolt-hole from the frame horn shall coincide

with the first or second rivet hole and shall be located at least 1 in. above the frame-horn lug. Clearance must be provided for the bolt-head inside of the frame channel.

The second bolt-hole shall be located on a line passing through the center of the first bolt-hole at an angle of 15 deg. plus or minus 2 deg. above the horizontal and at a distance from the first bolt-hole of from 3¼ to 4¾ in. In cases where the second bolt-hole is to be used for mounting a shock absorber, the hole shall be located not more than 1 7/16 in. from the bottom of the frame channel at the nearest point.

There should be normally a clearance of ¼ in. between the side rail and bumper bracket so that the latter will clear the rivet heads.

In case passenger cars are not equipped with bumpers as standard equipment, it is intended that a flat-headed

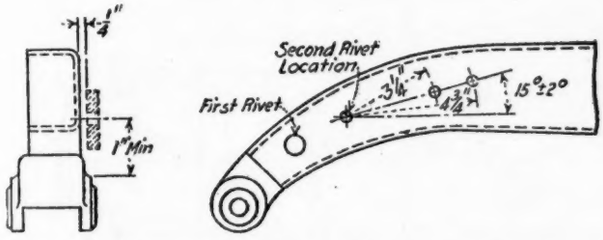


Fig. 1—Proposed recommendation for passenger-car bumpers

bolt shall be used in place of the first or second rivet to facilitate mounting bumpers as accessories.

Iron and Steel Specifications

The matters outlined below were brought out at the February Iron and Steel Division meeting:

Chemical Compositions.—The suggestion made by E. A. Johnston of the International Harvester Co., to reduce the standard carbon-steels to the least number required was discussed in connection with present practice among steel producers and parts manufacturers. A conference on the subject is to be arranged between the members of the Division and representatives of the International Harvester Co. and other implement manufacturers.

It was stated that at the present time there is no composition in the carbon steel group suitable for steel spring wire. The steel used by the steel-wire manufacturers ranges around 0.65 per cent carbon and 0.75 to 1.05 per cent manganese, but it is thought that if there were an S. A. E. Steel designated as Steel 1065 concerted effort among steel mills would practically bring about its universal use. S. A. E. Steel 6150 is easily obtainable and used to some extent for the purpose in mind, but the greater volume of spring wire is made from carbon-steel. It is understood that the steel-wire mills required the specially high manganese content in the carbon steel because of difficulties in the drawing operations encountered with lower manganese steels.

Chairman Gilligan of the division appointed a subdivision with A. L. Danse of the Cadillac Motor Car Co. as chairman to investigate the practice of the steel wire mills and prepare a tentative report for the division.

Bessemer Steels.—Attention was given to the subject of standardizing bessemer-steel specifications, as the following comments had been submitted:

Outside of S. A. E. Steel 1112, screw stock, which could be a bessemer steel, the automotive engineers are strongly in favor of the open-hearth process, due largely to the low phosphorus content possible in open-hearth steels. However, the attitude toward bessemer stock is not altogether justified, as perhaps 85 per cent of the steel going into the products of a large number of the implement manufacturers is bessemer steel.

The opinion was expressed that if bessemer steels were included in the specifications, there would be danger of automobile manufacturers using them when open-hearth steels are not readily obtainable. The Division members present were of the opinion that it would be unwise to mix steels such as the bessemer types, which are used by the agricultural implement manufacturers, with those now included in the S. A. E. Steel Specifications which are used by the automobile and tractor industries. As it was deemed inadvisable to make a final decision, it was voted to table the subject until further information should have been received.

Cast Iron.—The suggestion that the Division take up the matter of the adoption of standard specifications for cast iron was discussed. Previous attempts of the Division to prepare such specifications were mentioned and the opinion expressed that before the subject is taken up, tentative specifications for as many grades of cast iron as may be considered necessary should be submitted. It was noted that the tendency is toward specifying the grades of cast iron according to the Brinell hardness instead of by chemical analysis.

Sheet Steel.—A progress report was submitted from W. C. Peterson that data are being collected for a general specification for sheet steel and that a tentative report should be ready for consideration by the Division at the next meeting.

Leaf-Spring Stock

At the Iron and Steel Division meeting held on Oct. 21, 1921, M. P. Rumney explained that there is lack of uniformity of practice in rolling leaf-spring stock and that the following proposal, which had been submitted by the Leaf-Spring Group, is the best compromise that could be made between the varying practices in different mills. It was decided to circularize the proposal among manufacturers and users of leaf-springs for comment.

Rolling Tolerances for Concave Automobile Spring Steel

The finished bars shall be of double-concave section with round edges. The radii of the arcs of the two concave surfaces shall be of equal length.

Rolls to produce the round edges shall be turned to a radius equal to two-thirds the thickness of the bar.

All bars ordered to gage shall be rolled to the Birmingham wire gage.

All bars must meet the width and thickness tolerances specified in Table 1.

TABLE 1—WIDTH AND THICKNESS TOLERANCES

Width of Flat, in. Over	To, Inclusive	Width, in. Plus	Width, in. Minus	Thickness,[1] in. Plus	Thickness,[1] in. Minus
0	2¼	1/32	0	0.005	0.005
2¼	3	3/64	0	0.006	0.006
3	5	1/16	0	0.007	0.007

The difference in thickness between the two edges of each bar shall not be greater than those given in Table 2.

TABLE 2—DIFFERENCES IN THICKNESS

Width of Flat, in. Over	To, Inclusive	Difference in Thickness, in.
0	2	0.002
2	3	0.003
3	5	0.004

Spring-steel bars shall not have more than 1 in. curvature in 20 ft., or 1¼ in. in 25 ft., or 1½ in. in 30 ft.

[1]Thickness measurement to be taken at edge of bar where concave surface intersects round edge.

The concavity, the difference between the thickness at the edges and at the center of the bar, shall be as specified in Table 3.

TABLE 3—ALLOWABLE VARIATIONS IN CONCAVITY

Width, in.	Nominal Concavity, in.	Maximum Concavity, in.	Minimum Concavity, in.
1½	0.007	0.009	0.004
1¾	0.008	0.010	0.005
2	0.010	0.012	0.006
2¼	0.011	0.013	0.007
2½	0.013	0.015	0.009
3	0.016	0.018	0.012
3½	0.018	0.020	0.013
4	0.021	0.023	0.016
5	0.029	0.031	0.023

Motorboat Controls

Further standardization of motorboat controls has been suggested. It would be helpful if a standard reverse-control mechanism could be provided on all standard marine engines so that the motorboat builder could connect standard bridge-deck controls direct to the engine builders' control equipment, which it is impossible to do on any standard marine engine to-day, for it is necessary for the motorboat builder to throw the regular reverse lever away and build his own controls from the bridge-deck control position all the way to the reverse gear.

The same conditions apply in every respect to the spark and throttle controls, as the engine builders only provide brass levers here and there wherever they can be mounted.

Passenger Car Frames

The S. A. E. Recommended Practice for Passenger Car Frames was reviewed by the Frames Division at a recent meeting, and it was found that although certain parts of the Recommended Practice are in accord with present practice, much is obsolete. It was decided to circularize the industry for information as to present passenger car frame practice, and the information on the subject in the possession of the Society has been referred to the subdivision. There is now a tendency toward the use of frames with straight parallel side members, and if the data received indicate a sufficient use of this type, a recommendation for its standardization will be made by the Division.

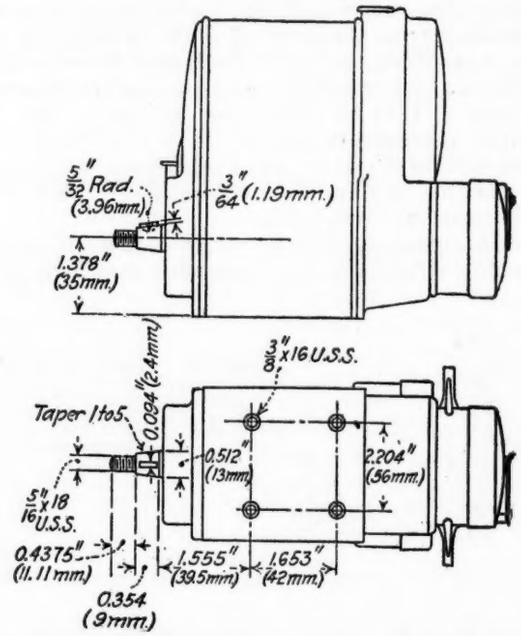


Fig. 2—Preliminary proposal for a standard magneto mounting

The standardization of magneto mountings for stationary engines, isolated electric-lighting plants and small tractors is one of the most important problems before the Electrical Equipment Division. At the meeting held recently in Chicago by the subdivision appointed to formulate a recommendation a preliminary proposal, Fig. 2, was approved. This has been submitted to engine and magneto manufacturers for comment.

The proposal will be considered at the next meeting of the Division.

A Handbook on the Airplane Engine

THE rapid advance in the design of aircraft engines in recent years has rendered handbooks on the subject written previous to the war obsolete. Research work carried out by the aircraft departments of all the belligerent governments added enormously to the stock of practical data bearing on engine design, and the keen competition between designers developed many new features of construction and new operating methods. Much of the information developed is scattered in voluminous and sometimes padded official reports, from which it can be obtained only at great difficulty. Prof. Lionel S. Marks deserves the thanks of the aircraft industry for having written an up-to-date handbook on aircraft engines. In this book, entitled "The Airplane Engine," McGraw-Hill Book Co., the author presents the results of war-time and later developments in this line, together with information of an elementary character on internal combustion engines. Where there is so much material to draw upon as there was in this case, there is always a temptation to use the scissors and pastepot rather freely, which usually results in an unsystematic compilation, and some of the volumes on aircraft subjects which have made their appearance since the war suffer decidedly from this fault. Of Professor Marks' volume it can be said that the material it contains has been thoroughly digested and arranged in a logical manner, thus forming a very readable and instructive book.

The author states in the preface that his work serves two objects: To formulate existing knowledge of the functioning of the airplane engine and its auxiliaries, and to present and discuss the essential constructive details of those engines whose excellence has resulted in their survival. The first sixty pages are devoted to the general theory of the internal combustion engine. Then in a chapter on Engine Dimensions and Details is given an outline of the different types of engines used for aircraft, and this section of the book contains brief specifications of most of the engines that achieved prominence during the war and since. Next, the author takes up the different component parts of the engine, as well as the various lines of accessories, dealing with each subject in considerable detail. The final chapters of the volume deal with such topics as Supercharging, Geared Propellers, Starting, Manifolds and Mufflers.

The book is well illustrated and contains a wealth of tabular matter, and it should prove helpful to the designer of aircraft engines, as well as to other students of the subject under discussion.

The Use of Alcohol as Fuel in Exported Vehicles

Alcohol is less expensive than gasoline and kerosene in many Central and South American countries, and has been used as a substitute in numerous cases. Several problems which should be considered by automotive exporters are met in its use. Some are discussed and remedies suggested.

By Herbert Chase

THE high price of gasoline and even kerosene in South and Central American countries, the West Indies and some other localities in which there is abundant raw material from which to produce alcohol, but no developed petroleum reserve, has led to a considerable use of alcohol as a motor fuel, and there are reasons to believe that such a fuel will see a wider application in the future, especially in view of the probable advance in the price of all petroleum products. In Cuba and in the Pernambuco district of Brazil, in particular, alcohol has already been extensively used as a motor fuel, and there is a growing interest in this possible substitute for gasoline, especially in sugar-producing communities, where a cheap raw material, which is now a more or less useless by-product of the sugar refineries, but can be converted into alcohol, is already at hand. The low price to which sugar products have recently fallen increases the interest in supplying national needs from local resources, and most of the countries in question are keen, for patriotic and other reasons, to develop these resources and to free themselves from dependence upon imported fuel, which is usually so expensive as to materially curtail the use of passenger cars, trucks and tractors.

Use of Alcohol

Alcohol is in many ways an excellent fuel for automotive purposes, but there are certain drawbacks to its use which can, however, be largely if not wholly overcome by relatively minor changes in design. The purpose of this article is to point out some of the conditions in this regard which must be met, and to suggest means for meeting them, as it is believed that automotive sales to the countries in question can be greatly stimulated by intelligent efforts to accommodate the product to the fuel which is available or will be made available when vehicles intended for its use are in the market. Manufacturers of trucks and tractors, as well as passenger cars, have an excellent possibility of increasing their export business, not only as a result of early sales which are likely to be made possible by the fact that their product is especially suited to the use of fuel alcohol, but due to the good will which such a product would create, both because of the cheaper fuel which it makes available or more readily usable, and because of the fact that patriotic peoples favor the use of products which are adapted to the use of home-produced fuel.

Recent reports from Cuba, collected by *El Automovil Americano* from consular and other sources, indicate that the consumption of fuel alcohol there has reached a total of over 600,000 gallons per month, although this fuel, which retails at 22 to 27 cents per gallon, has to meet the competition of gasoline at 41 to 46 cents per gallon, a much lower price for the latter than is prevalent in most Central and South American countries, in which gasoline often brings 70 to 90 cents. This is significant as showing the extent to which a native product is employed in the face of competition with a fuel for which the vehicles are primarily designed. The formula for denaturing motor alcohol, known officially in Cuba as "espiritu motor," provides for the addition to 95 per cent alcohol of 10 per cent of gasoline or sulphuric ether and about 1 per cent of other diluents, including formol, piridine and a coloring matter, which distinguishes this fuel from alcohol used for ordinary industrial purposes. However, other alcohol mixtures are permitted and extensively sold.

Cuban Motor Alcohol

Motor alcohol is made from the lower grades of molasses, which now sell at about 2 cents per gallon, and about 2½ gallon of this material is said to be required to make 1 gallon of alcohol. It is thought that it may later prove profitable to manufacture alcohol from the pressed cane fiber (bagasse), which is now largely consumed as fuel for sugar mill furnaces. Under present conditions alcohol is produced to sell in bulk at about 20 cents per gallon, but it is being so extensively used that the producers contemplate early increase in prices.

Reports as to the relative performance of cars using alcohol as compared to those using gasoline vary, but the rapid increase in the consumption of the former indicates that it can be used, at least for a time, with reasonable satisfaction by simply increasing the size of the fuel jet. As will be explained later, cars which use alcohol with only such a change will usually travel fewer miles per gallon of fuel, but there are some reports that the total consumption is not increased. In some cases this may be due to the fact that the gasoline consumption was higher than necessary, had the adjustment of the carbureter been correct.

Under normal conditions the cost of alcohol production in Cuba may be higher than at present, and the price of competing gasoline may also vary, but imported gasoline is now heavily taxed. Gasoline made from imported crude petroleum, refined in Cuba, is not, however, under the same handicap. Nevertheless, because of the appeal to local patriotism which a native product has, it seems quite likely that cars, trucks and tractors which show an equal or better performance on alcohol as compared to gasoline will find a ready market, providing, of course, arrangements for the proper distribution of the native fuel are made. In at least one case an American tractor manufacturer has already found a considerable market for his

product when the latter was equipped with special facilities for economically burning alcohol.

According to reports* dated January, 1922, received from C. R. Cameron, United States Consul at Pernambuco, Brazil, about half the automobiles operating in and about that city were using alcohol as fuel during the first few months of last year. The fuel is described as "42-deg. cane alcohol," to which was added as a denaturant 5 per cent of kerosene, gasoline, benzol, sulphuric ether or castor oil. Some 20,000 gallons of this fuel per month are reported to have been consumed. It is estimated that about 90 per cent of the cars which did employ this fuel have discontinued its use and are again using gasoline, which is considerably more expensive. The following reasons are assigned for the change from alcohol back to gasoline:

1—Fewer miles per gallon. 2—Decrease in power, with consequent difficulties on grades or under heavy loads. 3—Difficulties in starting with engine cold. 4—Solvent or chemical action of the fuel on tanks and fuel lines, with consequent clogging of fuel pipe or carbureter. 5—Rusting and wear of cylinders, ascribed to lack of proper lubrication. 6—Lack of reliable standard fuel which contained varying quantities of diluents. 7—Difficulties of securing a sufficient supply of high-grade fuel on short notice.

Overcoming Difficulties

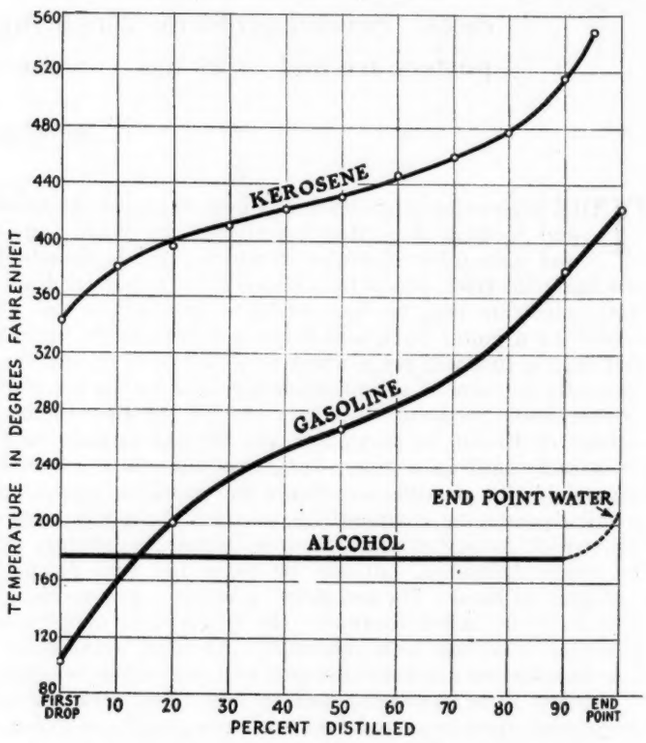
The report states that it is claimed that all these difficulties are overcome by the use of an engine especially adapted to burn alcohol, the adoption of a standard fuel of approved merit and by giving notice to the producers long enough in advance to enable them to meet the demand. In spite of the difficulties encountered to date, there is still a strong belief that alcohol will be the future automobile fuel, while the Brazilians regard it as a patriotic duty as well as an economy to use the native product. Accordingly, American manufacturers of passenger cars, trucks and tractors which can be adapted to the use of alcohol as fuel are advised to investigate the Pernambuco market. That it is an excellent market for automotive products is demonstrated by the fact that there are now in use in that district at least 1300 passenger cars and 200 trucks, most of which have been acquired since 1919.

Adapting Vehicles for Use of Alcohol

The difficulties encountered in the use of alcohol as fuel for automotive vehicles in Pernambuco are by no means insurmountable, but are such as might be expected whenever a fuel for which the vehicle is not primarily designed is employed. Alcohol is in some respects a better fuel than gasoline, but it requires somewhat different handling and some relatively minor changes in design and construction to produce the best results. These include, in general: (1) A considerable increase in the compression of the engine, obtainable either by the use of longer pistons, or, better, in the case of an engine with separate head, of a shallower combustion chamber; (2) provision for supplying more heat to vaporize the charge than is ordinarily used; (3) slight changes in carbureter adjustment, and (4) provision for preventing or minimizing the corrosive or solvent action of the fuel on metal and other parts. In some cases special aids to starting may be required unless the diluents used to denature the alcohol are sufficiently volatile to serve this purpose.

Considering, in order, means by which these conditions can be met, we find:

1—Alcohol can be used with a compression ratio of about 6 to 1 without producing detonation, and is, of course, productive of much higher efficiencies when so used. Gasoline cannot be used with such high compression without violent knocking, hence a larger clearance or compression chamber is required. It is a simple matter, however, to provide for the increased compression by furnishing a special head, and it might in some cases be desirable to furnish two heads, one designed for use with alcohol, and a second which could be applied in case some temporary local condition made it necessary to use gasoline. With the high-compression head it is possible to secure both a higher power and a better economy. The thermal efficiency increases with increase in compression ratio, and it is possible for this reason to secure more miles per



Distillation Curves for Alcohol, Gasoline and Kerosene

gallon of fuel, although alcohol contains less heat units per gallon than gasoline. To accomplish this result involves, of course, a proper carbureter adjustment and other favorable conditions in the preparation of the charge prior to combustion. Unless the compression is raised, the consumption of alcohol will usually be greater than that of gasoline, though the matter of correct carbureter adjustment in both cases may be the controlling factor and account for the conflicting reports as to relative mileage per gallon on the two fuels.

It is entirely possible to secure more power with alcohol than with gasoline even without a higher compression, but the difference will be greater when the compression is raised. The lack of power attributed to the use of alcohol in the report from Pernambuco quoted above may have been due to a variety of reasons, some of them resulting directly or indirectly from alcohol, but not insurmountable or necessarily inherent in alcohol fuel.

2—Alcohol requires more heat for its vaporization than any other of the more common hydrocarbon fuels, but it is completely vaporized at a much lower temperature than is required to vaporize the heavier ends of present-day gasoline and kerosene. On the other hand, it does not contain the volatile ends which are characteristic of gasoline, and, therefore, it is not so easy to start when alcohol is used as fuel as when gasoline is employed. To meet these conditions it is desirable to provide an inlet manifold which is well heated by exhaust gases, and install

*The full report on the subject as applied to Pernambuco can be obtained from the Automotive Division of the U. S. Bureau of Foreign and Domestic Commerce by referring to Exhibit No. 48027.

means for carrying a volatile fuel to be used for starting only, or some type of priming device which provides enough heat to volatilize alcohol in starting when the engine is cold. Once started, sufficient heat can be taken from the exhaust to vaporize the alcohol, providing a properly designed exhaust jacket for the inlet manifold is used. A. W. Scarratt of the Minneapolis Steel & Machinery Corp., which has developed tractors for using alcohol, has secured good results by using an inlet manifold design similar to that employed on kerosene-burning tractor engines.

In case an exhaust-heated manifold would provide more heat than is desirable for operation on gasoline (and gasoline may have to be used at times in localities where fuel alcohol is not uniformly or regularly distributed), it is an easy matter to provide means for shutting off all or a part of the heat. Aids to starting are not always required, especially when the car is to be used in very warm climates or when the denaturant used in the fuel provides the light ends which facilitate starting.

Distillation Curves

One of the curves given in the accompanying chart shows the temperature at which alcohol containing about 5 per cent of water (commercial alcohol contains varying percentages of water) distills. For comparison, similar curves for the average gasoline sold in this country and also that for a representative sample of kerosene are also given.

3—The changes in carbureter adjustment required in changing from gasoline to alcohol involve in general an increase in the size of the fuel jet, or what amounts to substantially the same thing in some carbureters, a decrease in air supply, either of which changes results in the use of a richer mixture. Of course, if the adjustment used for gasoline is excessively rich, as, unfortunately, it is apt to be in some cases, it may be possible to operate on alcohol without a change in adjustment.

4—That fuel alcohol, even when mixed with gasoline or kerosene, has a corrosive action on metals frequently used in the fuel system seems to be a well-established fact. This is attributed to an electrolytic phenomenon, and is apparently most serious in the case of galvanized sheet steel, such as is often used for fuel tanks. In this case particles of zinc are dissolved from the surface and may cause stoppage of fuel lines, carbureter passages and the like. In time the fuel tank will be sufficiently corroded to leak and thus require renewal. Copper is said to be affected to some extent, brass rather less and aluminum little if at all. Some reports regarding lead are to the effect that it is not injured, but tern plate (sheet steel coated with a tin-lead alloy) is said not to give satisfactory results. Steel parts sometimes used in float valves are apt to show corrosion, but brass, monel metal or even high nickel steel alloys can probably be substituted with satisfactory results in most cases, though precise information in this respect is lacking. Tanks of aluminum, lead-coated steel, brass or even copper will probably give satisfactory life in most cases and are certainly much more durable than galvanized iron. Brass is probably better than copper for piping between tank and carbureter, while the brass and bronze parts of carbureters, so far as we have heard, give satisfactory service. Shellac coatings on cork floats are soluble in alcohol, but some other coatings may be satisfactory. In general, however, metal floats are said to be preferable.

So far as we have learned, parts above the carbureter are not seriously affected, although some corrosion of valves and possibly some surfaces of the combustion chamber may occasionally occur. This may be due to the presence of acetic acid in the products of combustion, a fact which may also account for the muffler rusting out in one or two cases which have been reported. Such trouble is probably not serious in many cases, especially as the parts affected are not usually expensive and can be readily replaced.

On the whole, it is probably neither difficult nor expensive to make the slight changes in construction desirable to prevent any serious trouble from the corrosive action of alcohol. The freedom from carbon deposit in the cylinders, which is characteristic when alcohol is used as fuel, will probably more than offset any slight difficulties which may result from corrosion when the materials suggested are employed.

Trouble, which may in some cases result from a lack of uniformity in the alcohol fuel employed in various localities, cannot always be guarded against, but will probably not often occur if the changes referred to in respect to equipment are made. It may well be that some of the troubles laid to lack of uniformity in fuel are due rather to the cumulative effect of corrosion causing stoppage of fuel lines and the like than to actual variation in fuel quality. On the other hand, it is well to remember that alcohol and water are readily miscible, while gasoline and water are not, so that unreliable vendors may cause some trouble by diluting fuel with water, although a moderate amount of such a diluent may have no ill effect. Nearly all commercial alcohol contains 5 per cent or more of water. Other ordinary diluents, such as benzol, gasoline, kerosene and sulphuric ether, will probably not have ill effects unless the proportion used is excessive, and this is not likely, since they are apt to be more expensive than the alcohol itself.

There is a possibility of trouble from the use of castor oil, which is reported to be one of the denaturing agents used in Pernambuco, as this is relatively non-volatile and is apt to form a leathery carbon deposit. It may also form an emulsion which would cause trouble in the fuel system. Rusting and wear of cylinders referred to in the Pernambuco report and attributed to insufficient lubrication may be due in part to inadequate oiling, but the formation of rust is more likely due to the presence of acetic acid in the products of combustion, which would probably not do any serious injury to wearing parts, except perhaps if the car is allowed to stand idle for long periods after running on alcohol.

Conclusion

From the foregoing it will be apparent that the use of alcohol as automotive fuel is not without certain drawbacks, but that most if not all of these can be overcome or are not serious, providing reasonable precautions are observed and the vehicle properly adjusted and adapted to the conditions to be encountered. Some experimental and development work will be required in most cases, but the manufacturer who seriously and intelligently tackles the problem should in the end profit accordingly.

RESEARCH work looking to the production of a national motor fuel is being continued in France under the auspices of the "Scientific Committee." The work has been assigned to sub-committees and is being carried on at the National Powder Factory, at the College of Arts and Trades, at the National Agricultural College in Douay and at private laboratories. The Minister of Agriculture has placed 50,000 francs at the disposal of the Douay school and the Minister of Finance has contributed 400,000 francs to a research fund and 500 hecto-liters (12,500 gal.) of alcohol for the experiments. The use of alcohol for the motor bus service in Paris is being continued, the daily consumption being in the neighborhood of 8500 gal.

Exports of Passenger Cars, Trucks, Tires, Tractors,

COUNTRIES	GASOLINE PASSENGER CARS						GASOLINE TRUCKS						PARTS	ELECTRIC PASSENGER CARS AND TRUCKS	
	Up to $800		$800 to $2000		$2000 and over		1-ton inc.		Over 1 to 2½-ton		Over 2½ tons				
	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value	Value	No.	Value
Europe															
Austria													$105		
Azores and Madeira Islands													1,651		
Belgium	111	$52,148	9	$9,042					19	$8,193			6,243		
Denmark			21	20,193					1	1,000			37,064		
Far Eastern Republic															
Finland					1	$5,000									
France	2	750	3	2,808	2	10,500							56,258		
Germany					1	3,000							75		
Gibraltar													1,339		
Greece															
Iceland and Faroe Islands			1	1,465	1	10,309							461		
Italy					1	3,000							4,564		
Malta, Gozo, and Cyprus Islands													27		
Netherlands	29	15,217	9	9,647			42	$21,607					6,892		
Norway	3	2,224	13	11,200									3,793		
Poland and Danzig													665		
Portugal													80		
Roumania													716		
Spain	4	1,245	21	23,031	5	12,122	1	1,116	1	1,100			31,638		
Sweden	14	7,978	29	29,282			1	396					9,991	6	$8,750
Switzerland					1	3,000							2,306		
Turkey in Europe	10	3,258							2	734			1,832		
England	2	1,583	22	23,519	1	2,100			1	2,014			342,661		
Scotland			4	3,628	1	2,500							407		
Ireland	1	350											6,622		
Yugoslavia, Albania, etc.													1,045		
North and South America															
Bermuda													44		
British Honduras													212		
Canada	60	35,878	126	146,198	39	133,895	2	1,245	32	34,374	8	$18,738	987,619		
Costa Rica			4	3,232			1	500	2	2,424			1,913		
Guatemala	6	4,800	5	5,329	2	4,641			2	2,600			2,450		
Honduras											1	3,800	3,677		
Nicaragua													220		
Panama	6	2,849	7	9,434			6	2,597					8,910		
Salvador									1	3,220			2,669		
Mexico	269	112,452	69	75,683	5	11,759	55	22,545	18	28,738	2	7,059	93,237	5	3,300
Newfoundland and Labrador			1	1,498									708		
Barbados													976		
Jamaica	28	12,530	9	10,376	2	7,000	3	1,286					7,597		
Trinidad and Tobago	3	1,234	5	4,236			12	5,097	1	1,530			3,836		
Other British West Indies	6	2,331	3	3,603	1	5,065			1	1,700			3,625	1	441
Cuba	19	8,515	12	13,324	4	12,500	4	1,423	1	500	2	6,960	26,927		
Virgin Islands of U. S.													918		
Dutch West Indies	2	745					2	861					2,129		
French West Indies													855		
Haiti	2	1,390	2	1,616									2,457		
Dominican Republic	2	882											4,654		
Argentina	4	2,940	33	38,295	2	6,000			1	1,500			93,204		
Bolivia													104		
Brazil			36	35,291	1	2,110							8,955		
Chile			1	975									4,509		
Colombia	3	1,167	1	1,034			2	710	1	934	1	5,700	5,803	1	575
Ecuador													2,354		
British Guiana	3	1,306											1,169		
Dutch Guiana													71		
French Guiana	1	640													
Paraguay													89		
Peru	1	310	2	2,848	1	3,000							5,960		
Uruguay	2	1,456	9	9,204			10	2,654			1	4,805	4,443		
Venezuela	51	23,233	5	4,590	1	6,000							4,781		
Asia															
Aden			1	1,108									315		
Algeria and Tunis															
Armenia and Kurdistan	30	11,331											469		
Ceylon	4	2,333	8	6,464											
China	29	15,341	19	18,810	1	2,200			2	5,115	1	1,516	10,076	2	1,603
Kwantung, leased territory			3	2,940									828		
Chosen														10	22,680
British India	21	15,205	52	46,964	2	8,365	2	2,198	25	28,547			23,692		
Straits Settlements			7	7,164									4,207		
Other British East Indies															
Other Dutch East Indies			6	5,505									8,709		
French Indo China													763		
Hejaz, Arabia, Mesopotamia													2,239		
Hongkong			3	3,042									1,329		
Japan	103	41,125	3	2,921	1	4,157	51	24,788	11	32,887			29,146	1	3,776
Java and Madura	9	3,000	19	22,788	2	5,700							13,519		
Palestine and Syria	10	3,777	8	6,932			1	515	2	2,226			10,258		
Persia															
Siam					1	5,000	1	1,400					254		
Turkey in Asia	6	2,266											101		
Australia	382	256,570	249	272,818	3	7,707	12	15,078	92	121,205	5	8,017	71,282		
New Zealand	17	10,388	78	72,229					3	5,310	1	3,000	31,628		
Other British Oceania	3	1,491											85		
French Oceania															
Other Oceania													388		
Philippine Islands	1	443	15	18,867									9,399		
Africa															
British West Africa	3	1,306	5	4,688			5	2,123	1	1,680			10,763		
British South Africa			47	51,075									13,476		
British East Africa													70		
Canary Islands	1	520	9	10,983	1	2,400	2	2,868					1,889		
French Africa	4	1,447											2,079		
Morocco													3,583		
Portuguese Africa	2	890											1,267		
Portuguese East Africa													733		
Egypt	61	24,221					7	3,060					4,562		
Total	1,330	$691,065	994	$1,055,879	83	$279,030	222	$114,067	220	$287,531	22	$59,595	$2,060,619	26	$41,125

Motorcycles and Aircraft for January, 1922.

TIRES						FARM TRACTORS		PARTS	MOTORCYCLES		AIRPLANES AND SEA-PLANES		PARTS	COUNTRIES
Casings		Inner		Solid										
No.	Value	No.	Value	No.	Value	No.	Value	Value	No.	Value	No.	Value	Value	
														Europe
														Austria
														Azores and Madeira Islands
100	$1,505							$6,149	68	$21,812			$2,207	Belgium
915	24,818	1,296	$4,537	110	$3,060			136	106	30,760				Denmark
60	810	50	150											Far Eastern Republic
														Finland
820	10,669	614	2,537	8	355	54	$21,481	2,534						France
				4	143									Germany
236	3,175	263	601	6	150									Gibraltar
30	345	10	75					223						Greece
12	110	10	66					200						Iceland and Faroe Islands
12	419	12	34						2	690				Italy
168	2,802	23	75			2	1,111	204	145	41,143				Malta, Gozo, and Cyprus Islands
172	5,055	36	142	22	1,102			103	1	75				Netherlands
				714	36,738									Norway
		3	14						10	3,000				Poland and Danzig
														Portugal
1,355	18,796	939	1,912	51	2,297	2	1,355	712	60	16,796				Roumania
1,548	27,914	1,223	2,578					460						Spain
									12	3,267				Sweden
116	1,487	258	427	32	1,110									Switzerland
24,812	321,848	1,922	5,112	400	11,032	173	14,373	64	51	13,738			15	Turkey in Europe
120	572	5	11			3	3,200		4	1,068				England
								22,965						Scotland
28	688	85	186											Ireland
														Yugoslavia, Albania, etc.
														North and South America
								17						Bermuda
25	242	38	85											British Honduras
7,654	98,572	12,467	20,253	391	14,759	50	53,955	41,080	11	2,586			7,579	Canada
55	1,258	32	85					84					10	Costa Rica
688	20,201	265	757	16	407				8	2,287			22	Guatemala
54	1,036	56	285					60	3	699				Honduras
34	734	55	111						30	4,464				Nicaragua
692	10,984	1,121	1,332	14	383			199	4	1,038				Panama
486	8,414	51	194	8	287									Salvador
1,993	42,730	4,080	12,346	24	643	22	36,695	9,883	37	10,150			10	Mexico
1	10													Newfoundland and Labrador
44	662	32	164											Barbados
778	10,701	542	1,020	42	1,250				1	75				Jamaica
559	8,570	806	1,760	310	9,478				3	800				Trinidad and Tobago
33	489	56	275	7	242				2	668				Other British West Indies
4,971	74,342	3,077	7,045	455	16,374			480	3	695				Cuba
42	683	34	78					1,511						Virgin Islands of U. S.
124	1,491	88	138										101	Dutch West Indies
175	2,151	32	53	2	44									French West Indies
272	3,458	500	965	2	98									Haiti
755	8,714	876	2,046	18	316			176	1	155				Dominican Republic
6,528	70,357	6,727	10,786	30	711	32	40,615	4,345					200	Argentina
78	1,876	145	476											Bolivia
1,688	22,076	332	1,246	16	400			81					1,325	Brazil
672	9,823	32	100	4	284			644						Chile
489	7,300	238	620	10	323	1	601							Colombia
41	787	270	699					305						Ecuador
74	776	20	58											British Guiana
50	787	56	144											Dutch Guiana
														French Guiana
														Paraguay
706	13,298	250	616	4	190			656						Peru
1,288	13,101	860	1,213			10	5,448				1	$5,000	10	Uruguay
1,118	17,287	981	2,070			2	12,778		1	394				Venezuela
														Asia
														Aden
2	297							2,530						Algeria and Tunis
						10	12,744							Armenia and Kurdistan
									4	1,200				Ceylon
73	1,255	5	25			3	4,400							China
						2	1,393							Kwantung, leased territory
						1	1,100							Chosen
530	7,469	104	192	162	8,285	3	3,306	115	8	2,034				British India
897	9,472	955	1,308	383	12,833			65						Straits Settlements
									1	715				Other British East Indies
24	193					1	371							Other Dutch East Indies
														French Indo China
														Hejaz, Arabia, Mesopotamia
1,030	15,255	60	145	199	3,431	1	1,096	321	90	26,100				Hongkong
1,072	10,920	1,178	2,546	36	1,084			309	3	434				Japan
1,160	8,719	209	521			4	2,314	49						Java and Madura
		20	52											Palestine and Syria
83	1,910	10	10											Persia
														Siam
1,788	29,406	737	4,907	23	1,339	6	2,541	1,191	240	69,523				Turkey in Asia
3,363	46,757	132	306	222	13,839			74	74	22,193				Australia
														New Zealand
														Other British Oceania
24	365													French Oceania
2,426	36,836	2,787	16,273	121	2,997			140	11	3,102				Other Oceania
														Philippine Islands
														Africa
753	21,690	844	2,742	24	889									British West Africa
4,209	79,638	116	359					352	3	818				British South Africa
98	1,162	161	330						2	624				British East Africa
188	2,277	449	621	20	726				1	300				Canary Islands
														French Africa
									10	1,480				Morocco
														Portuguese Africa
														Portuguese East Africa
								485						Egypt
$80,511	$1,148,616	48,935	$116,385	3,890	$147,599	382	$220,877	$98,902	1,010	$284,883	1	$5,000	$11,479	Total

Calcium Chloride Non-Freezing Solutions

Editor, AUTOMOTIVE INDUSTRIES:

I was particularly interested in your editorial entitled "The Year-Around Chassis" in the issue of Feb. 23, 1922, because it appeared so soon following the completion of a long series of tests for the purpose of developing a non-corrosive anti-freeze compound.

The investigation soon narrowed down to compounds in which calcium chloride was the principal ingredient. Other inorganic compounds do not produce the desired lowering of the freezing point; and substances such as alcohol, glycerine, kerosene and xylene were discarded on account of inflammability or high cost. The work was highly gratifying in that it developed a calcium chloride compound which had no corrosive action on steel, cast iron, copper, brass or solder, and but very slight action on pieces of brass and copper soldered together with a relatively large exposed area of solder.

In the course of this work, the compounds available on the market received comparative tests. While almost all of these compounds are put out by concerns of good repute, their corrosive action on soldered brass and copper was far from satisfactory. In every case the metal in close proximity to the solder, and particularly the solder itself, showed severe attack. Chemical analysis of the compounds seemed to indicate that their development must have been a "hit-or-miss" proposition, with no proper consideration for the factors involved.

The best commercial calcium chloride obtainable to-day in large quantities is slightly alkaline in action and contains about 1.5 per cent sodium chloride with less than 0.5 per cent of inert insoluble matter. It is well known that sodium, ammonium and magnesium salts present in calcium chloride brine will increase to a large degree the corrosive rate. Why, then, should one compound to-day on the market contain a sodium salt which reacts with calcium chloride to form an almost insoluble calcium compound with corresponding increase of the sodium chloride content? A test made adding the complementary radicle of the sodium salt combined with calcium instead of with sodium showed less than half the corrosion of the original.

The problem is essentially one of reducing not only chemical but electrolytic corrosion. The first depends on temperature, concentration and dissociation; the second, all of these, with the addition of the factor of electric conductivity. Since it may be assumed that the corrosive action of calcium chloride solutions is due to the concentration of chloride and hydroxyl ions, then the logical step is to add some substance which, without being harmful in itself, will decrease the dissociated portion or the *active* portion of the chloride and hydroxide present. In the case of the calcium compounds this is simple, but with sodium considerable study and tests are involved. A prepared sample of sodium-free calcium chloride, to which was added a substance which greatly decreased its dissociation, exhibited an almost inappreciable corrosion.

The factor of temperature is obviously not subject to control in the case of radiator compounds; and the concentration is fixed by the desired freezing point. The electric conductivity can be very much reduced, however, by the addition of organic agents which are well known to every electrochemist.

A point I wish to emphasize is the desirability of keeping the metal surface of the radiator free from films or deposits of insoluble matter. In this connection, one compound examined produced in a very short time a deposit which was nowhere less than .002 inch in thickness. From the thermal conductivity of the deposited substance, it was calculated that in a radiator made of .009-inch gage copper, the cooling efficiency would be reduced in the ratio of 80 to 1! A radiator is placed on a chassis for a definite purpose, and this purpose should never be forgotten. Protection of the radiator by coating the metal with an insoluble film is not logical and will not be successful.

To summarize, a calcium chloride compound for radiator use should contain ingredients: (1) To greatly reduce the dissociation of chloride and hydroxides, (2) to decrease as much as possible the electric conductivity of the solution, (3) which preferably form insoluble compounds (if any) with all the metals in question, but not with calcium, (4) which will not result in decreased cooling efficiency by deposits of scale or any insoluble matter, (5) which are not of such nature as to spoil perfectly good paint jobs in case the radiator is allowed to boil over, and finally, (6) the calcium chloride used should be of the highest quality commercially obtainable.

N. JULIEN THOMPSON,
Development Engineer, Stamford Rolling Mills Co.

Stability of Four-Wheel Drive Tractors

Editor, AUTOMOTIVE INDUSTRIES:

In your publication of March 9, 1922, in the second sentence on the article on page 554, I wish to call your attention to an error, as under the design of tractor indicated the tendency to rearing is not eliminated, it seems to me, for the reason that if the driving torque were sufficient to raise the front end of the tractor, such action would not relieve the torque from the back wheels because the front wheels are positively chained to the back ones, and if the front wheels were in the air they would merely be acting as a countershaft for the back ones and the tractor would be essentially a rear driving machine. I will be interested to know if your writer agrees with me in this understanding.

H. W. RILEY.

We agree that if the weight distribution in the four-wheel drive tractor is the same as that in the two-wheel drive tractor, the tendency to rear will be the same in both. But there is no reason why the weight distribution should be the same. We have a parallel case in the four-wheel drive truck, and it is well known that there is always much more weight on the front axle of such a truck than on that of a two-wheel drive truck of the same total weight.

In a rear wheel drive tractor, as only the weight on the rear wheels is effective in giving traction, designers place

as much of the weight as they dare on the rear axle. The small amount (about 10 per cent) remaining on the front wheels when the tractor is pulling a full load, is necessary for surety of steering under these conditions. The tendency to rear increases as the distance from the rear axle to the center of gravity decreases. In a rear wheel driven tractor the center of gravity must be kept close to the rear axle for the above reason, while in a four wheel drive tractor there is no such restriction on its location and it would be placed farther ahead. In such a tractor it is evidently desirable to have the front wheels carry considerably more than half of the total weight when the tractor is at rest.

With the same weight distribution there does not seem to be any difference in the tendency to rear as between a two wheel and a four wheel driven tractor. Let us consider the two wheel drive tractor. At the moment the front wheels leave the ground all of the weight originally on the front axle has been shifted to the rear axle. Now, torque on the front axle has exactly the same effect in transferring weight as torque on the rear axle. Evidently any less combined torque in the four wheel drive tractor than that which caused the rearing in the two wheel drive tractor would not move the machine, and as soon as the combined torque reached this value all of the weight would have been transferred to the rear axle and the tractor would rear.—EDITOR.

Positive Steering Mechanism for Track Laying Vehicles

Editor, AUTOMOTIVE INDUSTRIES:

Mr. Darnell, in the March 2 issue of AUTOMOTIVE INDUSTRIES, says he believes that the power required for handling the steering gear suggested by me in the Jan. 26 issue will be considerable, and that the speed of the steering worm for short turning will be inconveniently great.

I wish to say, that these suppositions are contradictory; furthermore, the only resistance in steering is constituted by the friction inside differential box 2, and the small secondary friction in the steering-gear train, caused by the primary steering friction inside differential box 2. It is an easy matter to calculate the steering resistance for a given machine, and it will then appear that this resistance compares very favorably with the power required for declutching and braking in present day "steering" mechanisms for track laying vehicles.

It is obvious that this eliminates the possibility of the speed of the steering worm for short turns being excessive.

It is quite unnecessary to use friction disks or any kind of "servomoteur," and the mechanism, therefore, not only *looks* very simple, but it *is* simple.

As I did not ask a patent for this construction, it may be used by any one.

H. C. OLIVIER, A.S.A.E.,
Holland.

Paint Standardization

Editor, AUTOMOTIVE INDUSTRIES:

Referring to your letter of March 17 outlining Mr. Franklin's idea of standardizing automobile painting materials, also your query as to what method of specification would be the best and most effective, chemical properties or physical properties:

It has been thoroughly demonstrated in the past that specifying chemical properties does not, by any means, insure a uniform varnish. This is due to the fact that no matter what raw materials are used, the quality and uniformity of the varnish is also dependent upon many other factors, such as temperature at which varnish is cooked, atmospheric conditions and the human factor.

Broadly speaking, any two varnish makers using the same formula and raw materials will produce two varnishes that will differ largely in physical characteristics.

The Government has recognized this fact, and their specifications as now issued, are based on a list of physical tests, which have been adopted after extensive experiments both by the Government's laboratory and the varnish manufacturers, both co-operating to obtain efficient and positive method of determining the quality of any varnish.

N. J. FAGAN,
Superintendent, Hildreth Varnish Co.

Paint Standards Desirable

Editor, AUTOMOTIVE INDUSTRIES:

The suggestion that the Society of Automotive Engineers take steps toward standardizing automobile painting materials and operations will doubtless be of value if properly followed out, with the co-operation of the manufacturers of these materials, although it will be a long time before definite standards can be laid down.

The first thing to be done, and the one which will take the longest time, is to establish as nearly uniform conditions of operation as possible, for all standardization of materials must be based upon operating conditions. Whether such uniformity can ever be satisfactorily attained is a question, for the factors affecting these operating conditions are so many that it will not be easy to control them in such a way as to bring about the introduction of uniform schedules. A commercial job of automobile finishing may be produced with a quality satisfactory in the minds of some, for a low priced car, with three coats of material, applied by flowing, while others consider that the only satisfactory finish requires ten or a dozen coats. Some plants are equipped for handling the majority of their materials by the spray process, while others have no such equipment. Some can bake; others must air dry. A further difficulty arises from the fact that necessary differences in pigment composition, due to the different colors demanded, cause differences in the working and drying properties of the japan colors or enamels used. The more one considers the complexity of the situation, the more stupendous the problem of standardization becomes.

With relation to the basis of standardization, we stand without question for a reference to physical properties, rather than to chemical formula. The production of finishing materials is an art which is in a state of constant improvement. New materials are becoming available, which in many cases are superior to those formerly used, and of these some are becoming extinct. The setting of a chemical formula standard would discourage further efforts at improvement, and would make it impossible for a manufacturer to supply a composition of different formula, which had been proved by thorough test to produce better results at lower cost than the one specified. On the other hand, if the standard established is based on the fulfillment of definite physical properties corresponding with what is actually required of the goods in use, improvement can readily be made.

More than one-half of the net success in use of any finishing material is due to its proper application and treatment in the hands of the user, and in issuing S.A.E. ratings, upon which a job shop could depend, this fact cannot be too strongly emphasized.

C. R. BRAGDON,
Chemical Director, The Ault & Wiborg Co., Varnish Works.

Methods More Important Than Figures in Marketing Plans

Correct basic statistics are essential to proper marketing plans. Difference in efficiency between the plans of various manufacturers, however, lies rather in the methods applied to the use of statistics than in variation in the statistics themselves. Relative efficiency of these methods discussed.

By Harry Tipper

THE individual manufacturer, considering carefully the methods to be used in his marketing of his product, finds it difficult to assure himself on many of the basic figures required for his operations. If the tendency of registrations is to be considered in estimating the probable future market, then the tendency must be calculated from accurate sources and the tendency determined from accurate methods of calculation. The same thing is true of production. The matter becomes a little more difficult when the study is extended to take in the conditions involved in the various territories and, consequently, the individual tendency of business in each territory in relation to any price group or any group of products.

The great difference in the efficiency of marketing plans, however, arises not so much from miscalculation based upon erroneous basic figures, but rather from the methods by which the market is to be reached and the variation in the efficiency of these methods.

The manufacturer may have a very excellent picture of the tendency of car registration, the tendency of car production, the condition of the business in the various territories, the growth of closed-car models, the relation between the new car and the used car in the market, and other items dealing with the general economic status. These are valuable, however, only as they point the way to accurate methods of reaching the market and maintaining it. This manufacturer may neglect the dealer, or put the weight of his pressure upon the wrong portions of the territory. He may put the extensive sales pressure or a competitive effect where the basic facts would indicate that this effort should be lessened, and, in fact, the success of his plan will depend almost entirely upon the way in which his basic facts are used to work out his plans in accordance with the things which they suggest.

In the last article which appeared in AUTOMOTIVE INDUSTRIES of March 23, the probable market for the manufacturer was indicated in an example given at the end of the article. This probable market was divided into the states by a further example and this article proposes to take up the matter from that point, showing how the manufacturer should use this information in relation to his plans of action.

The car manufacturers mentioned in March 23 article had a prospective market, arguing from past experiences, of a certain number of cars within their price group. The object in front of these manufacturers in making their marketing plans for the year is to accomplish this sale with the least cost per car and, at the same time, build the distributing elements into the skeleton of permanency as much as possible. Manufacturer "B" had a market probability of 2690 cars for 1923. His cars at present are being sold by five distributors through 250 dealers, mainly in the large cities and towns of 100,000 or over. Certain circumstances must enter into the plans at this stage in order to apply the basic figures of market differences to the particular case of this manufacturer's operations for 1923. So far the manufacturer has determined the following:

1. The percentage within his price group is four per cent. The total number of cars to be sold in his price group in 1923 is 72,000.
2. On the basis of a total new production of 1,800,000 for the whole industry.
3. Car manufacturer "B" has discovered that these figures, in comparison with his past activity, give him a market probability of 2690 cars.
4. Car manufacturer "B" has also figured each State in regard to its proportion of the 2690 cars and, consequently, whether the State is growing in activity or decreasing.

With this information before him, it is necessary for this car manufacturer to make certain decisions upon his sales work, his advertising work, his methods of distribution, etc. In order to do this, however, further information is necessary to bring these broad facts down to the unit of merchandising operation. The manufacturer must decide:

1. Whether he will continue to sell other distributors or deal direct with dealers.
2. What type of a dealer he desires to secure.
3. How he will lessen the mortality in his distribution.
4. What efforts he will make to maintain a full line of distribution, whether he will extend his present distributing area or intensify on the present area.

In order to make these decisions intelligently he must add to this accumulation of information a further knowledge on these points:

First—The relative efficiency of distributors and his own branches for his own particular business, considering its size and its position within the price group.

Second—The mortality in the dealer field, the number of changes to be expected in the functions of dealers, the number of new connections he must make in order to keep his distributing intact, the distribution of the car populations in his price group as between rural and urban, and as between large and small cities; the distribution of the dealer population available for his purposes, and the distribution of his present outlets in relation to the general field.

These facts are just as important to a reasonable development as the more general economic facts previously considered. They are not quite so easy to secure, however, and are subject to a larger degree of possible error than the registrations and production, all of which can be determined closely. The relative merits of distributors and branch representatives depend so much upon the personal equation in the particular considerations of an organization that there can be no standards of examination fitting the general situation closely enough to be of great value to the individual manufacturer.

Similarly, the number of dealers coming into and going out of the field within a year is variously estimated at figures so widely apart as to be useless unless they are further examined. Of course, the same thing is true as to the number of dealers in the field at any given time. Various sources of information will present figures so widely separated as to be useless unless they are verified by some establishment of standards or reasons.

The same difficulty surrounds all proper accumulation of information regarding the distribution of cars of any price group in town and cities of various sizes, and the relation between these elements of the business and the manufacturer's distribution. Discussions on these points will require, consequently, a larger development than is possible in this article, and most of these factors will be considered separately in succeeding articles so that they may be determined more definitely in their relation to the economic status in the field. It is possible, however, to consider the question of what is a dealer at this point as this question almost governs all the rest of the calculations to be made by the manufacturer if his marketing plans are to be properly based.

The automotive business, as we have pointed out in these articles, is the first industry for the manufacture of complicated machinery and the sale of it through dealers to the general public. Sewing machines, typewriters, washing machines, etc., are very simple in comparison and they do not run to the volume. As a consequence of this, the dealer is not retailing goods over the counter only. He is keeping the car running and doing a good many jobs required in that connection. A list of all the people who buy anything to resell in this business, who do service in any way, who repair or who buy at the dealer's discount, would run probably close to 150,000 but a large number of these could not be considered as dealers in any ordinary sense of the term as it is understood by the manufacturer securing distribution in this field.

The word "dealer" is a misnomer, anyway, as a term used to cover the multifarious activities required in keeping the car and the truck running on their way to the junk pile. These dealers should be classified and grouped into subdivisions before there is any real possibility of understanding their value, and some minimums should be set up which must be met before a man can be classified as a dealer so that the thousands of concerns who get a dealer's discount but buy only for themselves and thousands of others who sell a very limited number of accessories, etc., can be rightly placed and rightly estimated in any consideration of the matter.

Most of these should be eliminated entirely, and the list of dealers will be valuable to the manufacturer only as he knows:

First—What are the standards required to get on the list.

Second—How are the subdivisions arranged, and,

Third—What are the methods of keeping up with the changes.

When the number of dealers in this field is variously estimated at from 70,000 to 140,000, the basis for estimating offers no real security to the manufacturer unless he analyzes the list very definitely in relation to the basis so that their value to him may be determined carefully and thoroughly. The dealer establishment, as we conceive it, is an establishment devoted entirely to be the distribution and maintenance of automotive products at retail for the owners and buyers of such product. This dealer establishment must keep a stock and equipment, a place of business, a line of custom, and some kind of credit in order to be classified in this way.

In all the further analyses on planning for the market, the dealer will be determined from this standpoint, and any figures considered as to the number of dealers or the mortality among dealers will be based upon that standard requirement.

The Perpetual Inventory

THE perpetual inventory, or stores control system, is strongly urged by the Fabricated Production Department of the Chamber of Commerce of the United States as a better method in manufacturing establishments than the annual physical inventory, with its general disorganization and shutting down of the plant.

A practical pamphlet on the subject, which has just been issued under the title of "Perpetual Inventory or Stores Control," goes at length into the advantages of perpetual inventory and carries a series of illustrative forms. Doing away with the annual inventory of materials is only one of a number of benefits derived from the system as set forth by the department.

"The perpetual inventory test is an important link in a chain that makes less frequently necessary the burdensome and often inaccurate annual physical inventory. The annual physical inventory entails a general dislocation of plant and frequently a shut down lasting as long as three to seven days; and the results are not dependable. Hence the desirability of eliminating the annual physical inventory as far as possible.

"This is accomplished by independent checking of the material indicated as on hand on the perpetual inventory and bin tag records through a physical count of selected items of stores, and noting and correcting any discrepancies between stock actually on hand and the quantity shown by the bin tag and perpetual inventory records. These inventory tests are made periodically and systematically, preferably at times when the material selected is lowest, and the attempt is made to cover each item of supply at least once a year and important items oftener. It is possible by these tests, as supplementary to the bin tag and perpetual inventory records, to secure an accurate count of material without the burdensome annual inventory."

Copies of the pamphlet may be had in limited quantities free of charge from the Chamber of Commerce of the United States, Mills Building, Washington, D. C.

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Aviation Control Necessary

NOTHING more seriously demonstrates the necessity for Federal control of civil aviation than the hydroairplane accident on the route from Miami, Fla., to Bimini recently when five passengers were drowned due to breaking of a propeller when perhaps not 10 miles from land. The plane was operated by a pilot who presumably owned the plane and operated it as an aerial jitney. It was a single engine plane and he did not carry a mechanic and apparently had no signal system, such as is used by day or night. It is reported that a storm was predicted and the pilot should not have started on the 45-mile hop from Miami to Bimini.

The Aeromarine Airways, which operates a hydroairplane service from Miami to Bimini 45 miles and Nassau 187 miles and Havana 250 miles, and also from Key West to Havana 100 miles, uses two engines on each of its boats with capacity for 11 passengers, carries two pilots and two mechanics. They are equipped with distress signals for day or night and never leave on any trip without a weather report from the point of destination. The Aeromarine had 30 boats in service and since its start two years ago has never lost a passenger. It uses single-engine planes for sightseeing along the Florida coast, but not for cross-sea hops.

Aerial navigation should be regulated so that passengers are assured every protection by way of all safeguards that marine or land navigation calls for. A few accidents such as the recent one will work serious injury to the development of aerial transport. Accidents will give the plane a set-back similar to that suffered by airships due to the Roma and Z R 2 disasters.

Cooperation

THE proprietors of a suburban garage were asked whether they did not contemplate taking the agency for a car. They replied, "We inherited the agency for the Sennett when we took over the garage. We sold several, but the manufacturer maintained the position that as soon as we took the cars off his hands he was through with them and, as a result, servicing the cars as they had to be serviced the first few months ate up all the selling profit and we discontinued the agency."

Something is dead wrong. These brothers are usually well educated, keen men. They have made a reputation for themselves in the community for being honest automobile men, and as a result have secured a fast growing, stable clientèle. The car which they handled was a well-known low-priced one which would sell well in that locality, but the sales are all going to a competitor who backs his dealer.

If manufacturers will not realize the responsibility that retailing a car through a dealer entails he can never hope to have the loyal dealer organization so essential to success. When dealers understand the fundamental value of service they should be given every incentive to practice what they believe. It is only by such procedure that the manufacturer is going to attain the permanency of market which is so valuable.

The Cart Before the Horse

THE adjustment of sales quotas to absorb a predetermined production program has always been a more or less hit-or-miss proposition. It may be likened to putting the cart before the horse. The results secured are similarly awkward and equally uncertain. Both impede steady movement.

From time to time articles have appeared, and will continue to appear, in AUTOMOTIVE INDUSTRIES giving facts which show how essential it is to know the market and plan production accordingly. In these articles, manufacturers are given the benefits of research on a comparatively unknown subject, that of distribution with relation to production.

Until recently it has not been necessary to adjust production to market possibilities. As long as production was only limited by the ability to produce the common method was adequate. Recently the horse has slipped around behind the cart without our full

appreciation of the fact. It becomes vitally important to forget the method which places production as the prime factor and adjust the latter according to the market consumption.

Diesel Engine Development

CONSIDERABLE interest has been aroused in automotive circles by the work done by Sperry and others in attempting to reduce the weight of Diesel engines and to adopt them to construction in smaller units. When the Hvid engine appeared on the market some years ago it was felt that the Diesel principle had reached a state of development such that its introduction for automotive purposes was imminent, and the frequency of discussions on Diesel engines before the S. A. E. in recent years lends support to this view. But the distance from even the submarine type of engine—undoubtedly the most refined and developed up to the period of the war—to a practical road vehicle engine is a long one, and it will no doubt take a good many years more before the Diesel type of automotive engine is applied commercially to any large extent. Nevertheless, automotive engineers are keenly interested in any progress in the movement to make these engines lighter and more flexible.

It is natural that, since the Diesel engine is now being successfully used for marine propulsion, any smaller and lighter types developed should see their first application to motor boat work. In the marine field high operating speeds and consequent light weight are not so essential as in the automobile line, and lack of flexibility is not such a serious handicap. In this particular field, moreover, there seems to be a demand for engines of all outputs from those of several thousand horsepower down to the small outboard motors used on rowboats, and the size of the engine can be reduced step by step and the manufacturer be assured of a market for any size he may put out if it is otherwise of merit and can meet competitive prices.

Showing pictures of simple Diesel engines of low speed alongside of compound engine and claiming the difference in weight and bulk to be due to the compounding, may, however, give a wrong impression. One can imagine the compounding of an automobile type of Otto engine and then comparing it with a simple Otto engine. These engines are being built in small output, stationary types weighing several hundred pounds per horsepower, while simple Otto engines for aircraft work have been built weighing less than 2 lb. per hp. It will thus be seen that there are other factors influencing the weight—and incidentally the bulk—of internal combustion engines besides the splitting up of the expansion between two cylinders.

During the war a great deal of experience with Diesel engines was gained in all the large industrial countries, and it is little wonder that the firms engaged in this line of work are now seeking to enlarge the field of usefulness of that engine. Peculiarly enough, the Diesel engine seems to be limited as to size at both ends of the scale. It has been found that when a certain size of cylinder is reached further increase is practically impossible because of the difficulty of maintaining the working parts at suitable temperatures. At the lower end of the scale it is rather the comparatively high weight in proportion to output that is holding back further commercial development. That these limitations are gradually being overcome is shown by the results of Sperry's work and is also indicated by a report to the effect that a well-known British engineering firm is building a Diesel engine to weigh not over 5½ lb. per hp.

Distributors and Factory Branches

INVESTIGATION does not bear out the rumor, recently current, that many manufacturers are intent upon the elimination of the distributor and the installation of factory branches. While a certain number of factory branches are operated by manufacturers, there is no real tendency to operate entirely on this basis. Whatever trend there is appears to be in the opposite direction.

The composite opinion of about ten representative companies on this subject may be summarized about as follows: "We have no intention whatever of eliminating distributors and of substituting factory branches. In certain cases it may be impossible to obtain suitable representation in a given territory and a factory branch may be necessary. This is a matter of self-defense, however, rather than of desire to eliminate the distributor. We will never disturb a good distributor."

Certain factors of cost are sometimes neglected in discussing the relative economic merits of the two plans. The advantage of the initiative and ability of the man in business for himself as opposed to the man on salary, for example, has an important bearing.

Tribute

THE following sentences which appeared in a recent copy of a London newspaper may well be given a few moments' notice by American manufacturers:

"Motorists have a good deal for which to thank the American car manufacturer. For instance, the importation of transatlantic cars in relatively large numbers in recent years has had a marked effect on the value which our producers are offering to the motorist. Another lesson to which we would do well to pay careful attention is the interchangeability of parts in American cars and their supply, together with general chassis accessibility. Much improvement has recently been made here."

The feeling of self-satisfaction which may be enjoyed will probably be followed by a realization that the British manufacturer is also reducing prices and that the appreciation of our engineering features is likely to result in pursuit along the same lines. In other words, competition is going to be met more and more. Continued success of the American low-priced car in the export field means that we must always keep two jumps ahead.

March Biggest Month in Two Years

Carload Shipments Approximate 25,000

This Mark Has Been Equalled Only Three Times in Last 26 Months

NEW YORK, April 4—March was the best month the automotive industry has had since March, 1920.

Ford output was well over 70,000 and practically all other large producers turned out more motor vehicles than in any 30-day period in a year and a half.

This applies to all branches of the industry — passenger cars, trucks, tractors and parts. Passenger car output for the first quarter ran far ahead of the same period in 1921. The first quarter of 1920 was the largest the industry ever had. Truck production in the first three months of this year gained even more in comparison with the opening quarter of 1921.

Parts Sales Big

Sales of parts manufacturers in March were as large as in any month of 1921 and probably larger. The February total showed an increase of more than 100 per cent over the same month last year and was larger than in March of last year, which showed an increase of 93 per cent over February. A gain of only about 20 per cent for March of this year over the preceding month would put parts sales on a level with the banner month of last year. There is little doubt that an even larger increase will be shown.

Carload shipments of automobiles and trucks by all makers in March approximated 25,000. There have been only three months in the past 26 which have equalled this record. They were January 1920 with 25,057; February 1920 with 25,505 and March 1920 with 29,326. While the carload shipments in January and February 1920 were little larger than in March 1922, the number of driveaways was much larger. The comparison follows: March 1922, 15,800; January 1920, 29,283; February, 43,719; March, 57,273.

Carload shipments of automobiles and trucks in February numbered 19,600. The only months in a year and a half which have exceeded this figure were September, 1920, with 20,804; April, 1921, with 20,187; June, 1921, with 20,269; August, 1921, with 20,350, and September, 1921, with 20,150.

(*Continued on page* 789)

Business in Brief

NEW YORK, April 4. — Steel production continues to increase. Present rate of ingot production is somewhat above the levels of 1912 and 1913, the best pre-war years.

General freight tonnage carried by the railroads continues to increase, but the coal strike will bring about a sharp curtailment in the total tonnage carried. Car loadings for the week ending March 18 were 823,369, compared with 691,396 for the same week in 1921, and 855,060 for the corresponding week of 1920.

Railroads have released orders for 8,000 cars.

A return of 4½ per cent on the estimated valuation of Class 1 railroads is indicated by returns of 170 carriers for the month of February.

General indifference to the coal strike is still manifested in all industries.

Building operations, which already had approached record proportions, are increasing with the coming of spring.

Bank clearings for the week ending March 30 aggregated $6,156,364,000, a loss of 9.6 per cent from the previous week, but a gain of 20.9 per cent over the same week last year.

Stocks are buoyant, bonds higher and money and exchange steady.

Marked improvement in the condition of the agricultural industry and a better outlook for business generally are indicated in April 1 reports received by the War Finance Corp. from all parts of the country. Live stock growers and farmers are much more confident.

Strong demand for cattle has developed. Sheep and lamb markets continue strong.

Meat stocks in cold storage are unusually small.

Cash wheat and corn markets continue strong.

Cotton market remains quiet with a slight drop in prices.

Wool and textile markets are quiet.

Unemployment is decreasing in the Middle West, and farmers are absorbing considerable surplus labor.

April Schedules Call for General Increase

Detroit Hopes to Exceed March Production Figures by One-Third

DETROIT, April 3 — Tentative April production schedules in Detroit motor vehicle factories call for a general increase over all recent months, and the March figures will be exceeded about one-third in practically every plant. The new Jewett and the new Columbia will be in quantity production for the first time.

One or two additional models in existing lines are scheduled to be brought out, Buick being ready to present a new sport phaeton accompanying its sport roadster first exhibited at the New York show and Liberty having a new roadster which will follow the lines of its new phaeton and which will sell at the same price.

Jewett will turn out about 1200 phaetons, which with 1800 Paiges scheduled will give that factory an April total of 3000. In March 250 Jewetts and 1750 Paiges were shipped. Columbia will build 500 of the new line in April and about 700 of the former models.

Ford will put over its first hundred thousand month of 1922 in April, the March total for all plants, domestic and foreign, running about 70,000. There is a pressing demand for inclosed cars, the Ford company declares, and orders on them are 30 days ahead of possible output.

Dodge Brothers will continue on a capacity basis of 550 cars daily and is also far behind on inclosed cars. To speed up production, the company is reported to have discouraged the sale of inclosed cars for the next two months to permit it to reach highest production on the open models.

Hudson-Essex, with a total production in March of about 5000, will increase this in April to a point that will give the company the largest April in its history.

Maxwell will build 250 cars daily in April, increasing from the approximate 200 daily schedule in March. Chalmers, in March has been speeded up to a point schedule materially higher for April than for recent months.

Studebaker will build 11,000 cars in April and has scheduled the balance of the summer on that basis. Production in the face of a price increase, reports a which gives the company 440 a day going into April.

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All Recent Records Shattered

Factories in Flint Show Big Gain Made

Output for Months of First Quarter Leaps Far Above Last Year's

FLINT, MICH., April 4—Proof that the automobile industry is in a much healthier state than it was this time last year, and that its chances for improvement are good is evident from the statements of motor car company heads and the heads of allied plants.

"Our business for Feb., 1922, was 242 per cent greater than that of February last year," said H. H. Bassett, president and general manager of the Buick Motor Car Co. "March production was double that of last March, and there is every indication that our business will be better than the calendar year of 1921."

Chevrolet on Night Shift

Chevrolet Motor Car Co. has a schedule of close to 10,000 cars for April delivery, and last week started a night shift for the first time in several months. Nine hundred axles are now being turned out per day, and a production of 800 motors per day is the goal.

The Dort Motor Car Co. states that January showed an increase in production of 336 per cent as compared with Jan., 1921. February showed an increase of 150 per cent over January, and March made an equal gain over February.

Announcement has been made that the plant of the Flint Motor Axle Co. will soon be running on full time. The plant has been on a limited schedule for several months.

According to a statement made before a Chamber of Commerce group by John Edgerly, general manager, business for the Flint Varnish & Color Works, 95 per cent of whose output goes to motor car manufacturers, has improved 75 per cent.

Walter Heginbottom of the Marvel Carbureter Company reported good business conditions in the sales field for his company.

The Stewart Body Co. this week requested all of its mill employees to report for work.

Spark Plug Business Grows

Since January 1 the business of the A. C. Spark Plug Co., which before April 1 was known as the Champion Ignition Co., has steadily increased, according to B. de Guichard, assistant general manager. "This has been true both of shipments to jobbers and to manufacturers for original equipment," he said. "Business is more than double what it was this time last year."

Albert C. Champion is at present on a trip in Europe, and one of his duties is to perfect the organization of the A. C. factory being started in Birmingham, England. It is probable that a branch factory will be started in Paris, France, in the near future.

Highway Legislation Now Before Congress Embodies Ideas of Automotive Industry

By Roy D. Chapin

President of the Hudson Motor Car Co. and Chairman of the Highways Committee of the National Automobile Chamber of Commerce

DETROIT, April 3.

PASSAGE by the United States Senate of a highways appropriation bill fixing allotments of $50,000,000 for the fiscal year of 1923, $65,000,000 for 1924 and $75,000,000 for 1925, meets with the approval of the highway committee of the National Automobile Chamber of Commerce, and if accepted by the House will mark an important forward step in the development of a national system of highways.

It has been our earnest effort for several years to obtain the enactment of legislation which would guarantee to the States of the Union the continuance of Federal aid in the construction of highways over a period of years. In this present bill we have been successful.

To insure favorable action by Congress on the measure it devolves upon each and everyone in the industry to indicate his interest in the subject to his individual Congressional representative. Letters urging the early passage of the bill should go forward at once.

The steady growth of the highway system of the United States is a most important factor in the advance of the automobile industry. Federal participation in the highway plans and the assurance of it for future years is a vital force in stimulating the individual States to action.

Rolls-Royce Adds 200 Men to Machining Department

SPRINGFIELD, MASS., April 3—Rolls-Royce, Inc., is adding 200 men to its machining department this week. Increased production is also reported in bodies for the chassis. This expansion comes as the result of recent gains in sales and the improved prospects for spring and summer business.

Particularly worthy of note is the recent increase of business reported in the Chicago district, indicating that the North Central States are making a recovery from the agricultural depression that for months has retarded business.

Export Trade Picking Up, Wichita President Says

WICHITA FALLS, TEXAS, April 1.—Inquiries for trucks are greater than at any time since 1919 and export business is picking up, according to J. G. Culberson, president of the Wichita Truck Co. Culberson states that the plant is now turning out more than 60 trucks a month and that he expects soon to increase the output to the capacity of the plant, which is about 400 a month.

The company is doing business in half the States of the nation and is making shipments to several foreign countries.

Trucks Make Steady Strides to Recovery

Establish Gains Through Lighter Vehicles—Releases on Parts Increasing

DETROIT, March 29—The truck industry is making steady strides toward recovery and is coming back principally through the medium of the lighter vehicles. Every month this year has seen increased releases to the parts makers, March business doubling February, and April releases, already indicated, will double March.

Most of the releases are for parts for 1½-ton vehicles. There is considerable business in 2 to 3-ton sizes, but after three the business is light. For the present the heavy-duty truck has entirely given way before its lighter brethren.

Explanations for the buying of lighter trucks give it as an indication of a return of general business, but on a lighter basis than formerly and requiring more frequent deliveries of smaller shipments. It is also declared that many truck buyers, unable to finance the purchase of a heavy truck now, are using the lighter trucks temporarily.

All of the specialized unit truck builders are declared to be getting a volume of business, the amount depending largely upon their merchandising methods and the character of the clientele in which they specialize.

Nash Contract Has Price Cut Clause

Gives Dealers Six Months' Protection—Not to Be Rewritten Each Year

KENOSHA, WIS., April 3—A dealer contract which does not have to be rewritten each year, but holds good as long as the relationship between the factory and the dealer is mutually satisfactory and which gives dealers six months' protection on price reductions has been adopted by the Nash Motors Co.

Regarding the new contract, which is expected to be ready for distribution within a short time, Nash Motors to-day made the following statement:

The contract, once written, is continuous in the sense that it does not have to be rewritten each year, but holds good as long as the business relationship it cements is mutually satisfactory to the factory and the dealer.

The thought of the Nash Motors Co. behind this clause is that it wishes the Nash dealer to feel the permanency of his relationship with the factory and that he may retain this valuable franchise as long as he continues to give the Nash company satisfactory representation.

The second important feature of the new Nash contract is that the dealer is given protection on all current models of new Nash cars that he may have on hand and which may have been shipped him from the factory during a period of six months immediately prior to the announcement of any price reduction by the factory.

Saxon Leases Quarters in Ypsilanti Factory

DETROIT, April 3—The Saxon Motor Car Corp. has decided to remove its plant to Ypsilanti, where it has leased quarters in an automobile manufacturing factory already established. The company owns no real estate in Detroit and has rented the property it occupies here.

The Saxon company has requested its creditors to grant an extension of time on their claims. It believes that if this relief is granted, it will be able to extricate itself from its present difficulties. The plan proposed will not be put into operation unless 80 per cent of the creditors consent.

Protesting Methods Used, A. A. A. Secretary Resigns

WASHINGTON, April 1.—Resigning as secretary of the American Automobile Association and as editor of the "American Motorist," as a protest against the new methods of obtaining membership in the Washington district, the action of William Ullman has provoked widespread discussion in the automobile trade, especially among car dealers and owners.

Ullman has been prominently identified with organization work of A. A. A. for a number of years.

Simultaneously with his resignation several prominent individuals connected with the local division of the A. A. A. likewise severed their connection.

According to the statement issued by Ullman, his resignation was due to the employment of professional membership promoters by the A. A. A., under a contract signed by George C. Diehl, national president. Ullman said that the management of the local district division was removed from control of the advisory board and placed in the hands of professional promoters and the annual dues increased from $5 to $10. He claimed that hundreds of protests were received as to the methods used by the promoters against the increase of membership dues.

Denial that the organization was being commercialized has been made in a formal statement by Diehl. He contends that the increase in dues which Ullman protested was made to put the District of Columbia on an equality with other clubs which pay the $10 rate. Diehl insisted that it was a legitimate campaign which had been authorized.

A. E. A. Committee Works Toward Uniform Practice

CHICAGO, April 1.—The Standardization Committee of the Automotive Equipment Association met last week at Cleveland and adopted recommendations concerning 109 items of automotive equipment. The recommendations have to do with packing, marking and the elimination of sizes and types. The purpose of the committee is to endeavor to establish uniform practices among manufacturers as to sizes and types and methods of packing and marking. The elimination of unnecessary sizes and types is expected to result in considerable saving to makers and dealers.

The committee is now at work on the preparation of a handbook in which the recommendations it has adopted will be listed. The book also will contain extracts from the recommendations of the Society of Automotive Engineers. It will be a loose leaf book and additional sheets will be published as new recommendations are made.

KERN TO MAKE STATEMENT

WASHINGTON, April 3—The Alien Property Custodian announces that investigation of the sale of the Bosch-Magneto Co. to Martin E. Kern of Allentown, Pa., is still far from complete. Upon his return from Europe, Kern came immediately to Washington for a conference with officials of the department. He has stated that he soon will issue a statement of his case.

RECEIVER FOR LEASE MOTORS

NEW YORK, April 3—A petition in bankruptcy has been filed against the Lease Motors Co., Inc., manufacturers of motor trucks at Long Island City. The liabilities are said to exceed $75,000 and the assets, $50,000. The petitioning creditors have claims aggregating $1,600. Judge Knox has named Ely Newmann receiver.

Holders of Chalmers Notes Form Committee

Company Defaults in Payment of Interest—No Bearing on Maxwell Finances

NEW YORK, April 3—A committee to protect the interests of note holders of the Chalmers Motor Corp. has been formed here as the result of the default by the company in the payment of $94,000 interest due April 1 on $3,150,000 first mortgage, 6 per cent gold notes. The committee is headed by M. N. Buckner, chairman of the board of the New York Trust Co., with Alfred A. Cook as counsel. The other members are Philemon Dickinson of C. D. Barney & Co. and Martin F. Stern of J. S. Bache & Co.

It is stated by the committee that in its judgment "it is imperative that prompt and concerted action be taken by the note holders for their protection and that the notes should be deposited immediately." In order to participate in the benefits of the protective agreement, holders of notes must deposit them on or before April 20 with the New York Trust Co.

Maxwell Merely Stockholder

Walter P. Chrysler, chairman of the board of the Maxwell Motor Corp., stated to-day that he had no statement to make at this time in reference to the default on the Chalmers notes. It is asserted, however, that it has no direct bearing on the Maxwell finances, as the latter company simply occupies the position of stockholder and creditor toward the Chalmers company, having no liability for Chalmers notes or accounts.

When the reorganization plan to effect a merger of the Maxwell Motor Co., Inc., and the Chalmers Motor Corp. was declared effective, the first mortgage Chalmers notes were left undisturbed by the plan. The Maxwell Motor Corp., which was incorporated in West Virginia a year ago, owns more than 95 per cent of the capital stock of the Chalmers corporation. The Chalmers first mortgage notes, which are dated Sept. 1, 1917, were issued to provide $3,000,000 in cash to be used by the Maxwell Motor Co., Inc., under the terms of its lease of the Chalmers plant. They constituted a first lien on the real estate, buildings, plants and other assets formerly leased by the Maxwell Motor Co., Inc., and now a part of the property of the Maxwell Motor Corp.

Officers of the Maxwell corporation assert that its financial position is extremely strong. This is reflected in its ratio of quick assets to demand liabilities which are between six and seven to one. It is expected that capacity production will be approached in the next few months.

Aim Is Constructive Action

DETROIT, April 5—B. E. Hutchinson, vice-president and treasurer of both the Maxwell and Chalmers corporations, said

(*Continued on page* 791)

Stewart-Warner Wins Another Patent Suit

Decree Concerning Vacuum Feed Tanks Issued Against Ireland & Matthews

DETROIT, April 3—The application of the Stewart-Warner Speedometer Corp. for an injunction to prohibit the manufacture and distribution of vacuum gasoline feed tanks by Ireland & Matthews Manufacturing Co. of this city has been granted by Judge Tuttle in Federal Court here. The decree also ordered the Ireland & Matthews company to render an accounting to the Stewart-Warner company on account of infringement of the latter's patents.

It was held by the court that the Webb Jay patents covering the vacuum gasoline feed system, owned by the Stewart-Warner company, were infringed by the Weinberg tank, which was the type manufactured by Ireland & Matthews. Stewart-Warner has won a number of other similar suits against other manufacturers.

Opinion of Court

The interlocutory decree entered by Judge Tuttle is as follows:

1. That United States letters patent No. 1,132,273, granted to Webb Jay, dated March 16, 1915, for improvement in fuel feeding devices for internal combustion engines are good and valid letters patent as to claims nine and fourteen thereof.

2. That the complainant, Stewart-Warner Speedometer Corp., possesses the full right to said invention as covered by said patent No. 1,132,273, by virtue of an exclusive license thereunder from the complainant, Webb Jay, that the complainant Webb Jay is the owner, subject to said exclusive license, of the whole right, title and interest in and to said patent 1,132,273.

3. That the defendant, Ireland & Matthews Mfg. Co., has, by making, selling and using devices substantially such as shown in said United States patent 1,132,273, infringed claims 9 and 14 of said patent and has violated the exclusive rights of the complainant thereunder.

4. That the complainant recover of the said defendant all the gains and profits made by it and all the damage sustained by said complainant by reason of said infringement by said defendant of said claims 9 and 14 of said patent 1,132,273; that said cost be referred to William S. Sayres, Jr., having experience and special fitness in matters of accounting, residing in Detroit, Mich., as master pro hoc vice to ascertain and report to the court the number of said infringing devices made, used or sold by said defendant since said March 16, 1915, from infringing the said exclusive rights of said complainant by the manufacture, use or sale of devices infringing said claims 9 and 14 of said United States patent 1,132,273 and also the damages which the complainants have suffered by reason of said infringement.

5. It is further adjudged, ordered and decreed that a writ of injunction in accordance with the prayer of the bill of complaint herein be issued by, from and under the seal of this court perpetually restraining and enjoining the defendant, its agents, employees, servants, workmen and all others acting under or by its authority, from any further acts infringing the said claims 9 and 14 on said patent 1,132,273.

6. That the complainant upon said accounting aforesaid have the right to cause an examination of the said defendant or its employees or any of them and also to examine the account books, vouchers and documents of the defendant for the purpose of ascertaining the character and amount of such infringements and that the defendant and its employees and all other persons having custody of such account books, vouchers and documents of the defendant attend for this purpose before the said Master in Chancery at such time as said Master in Chancery shall direct.

7. That said complainants recover of the defendant their costs, charges and disbursements in this suit to be taxed.

GOVERNMENT TO FILM STORY OF PRODUCTION

WASHINGTON, April 6—Plans have been completed for the production of a motion picture film to be called "The Story of an Automobile," produced under the direction of the Automotive Division, Department of Commerce. It is part of their plan to interest the public in production methods. It has been announced that the work of filming the various processes will be started April 18.

Arrangements have been made with Dodge Brothers to show the complete methods of manufacture of an automobile from the new material to the finished product, and will bring out in a clear way the efficient methods used in this connection, as well as present in a graphic way the welfare work being carried on in the industry. No pictures will be released without complete approval of Government officials, and every effort will be made to give wide circulation to the films.

This line of endeavor on the part of the Automotive Division is in keeping with the policy of Secretary Herbert Hoover of placing every resource of the Government at the command of the automotive industry to promote the export trade and maintain the supremacy of American automotive products in the markets of the world.

Bassick Company Moves to New Chicago Plant

CHICAGO, April 3. — The Bassick Manufacturing Co., manufacturer of the Alemite lubricant system for automobiles, has moved to its new plant at 2630 North Crawford Avenue. The new plant has 70,000 square feet of floor space. It is one story high and of sawtooth construction, and so designed that artificial light will rarely be necessary. The ground area covers about 160,000 square feet, which allows for expansion.

The officials of the company state that there is an increased demand for their product and that 300 automobile dealers are using their equipment.

Reynolds Spring Co. Enters Radio Field

Accepts $5,000,000 Contract to Make Apparatus for New York Concern

DETROIT, March 31—Reynolds Spring Co., one of the largest manufacturers of automobile cushion springs in the industry, has accepted a contract from the DeForest Radio Telephone & Telegraph Co., New York, for the manufacture of its radio apparatus and parts over a period of ten years. An initial order approximating $5,000,000 will be shipped between April 1 and Dec. 31, 1922.

To manufacture the radio apparatus the company will employ its former plant in East Avenue, Jackson. Manufacture of its automobile springs was transferred recently to a new plant in Water Street, that city. The manufacture of the two differing lines will thus be kept entirely separate.

Announcement of the company's new activity was contained in a letter sent by President Wiley R. Reynolds to stockholders, in which he expressed the belief that the radio business will make rapid strides. No new financing will be necessary to enable the company to proceed with its radio business.

A license for the manufacture of bakelite has been obtained from the General Bakelite Co., New York, under which the company will begin the manufacture of new parts for the automobile industry as well as for radiophone purposes. The bakelite products will be marketed through a separate selling organization. From 300 to 500 employees will be added.

Trade Bodies to Discuss Exports with Gordon Lee

NEW YORK, April 3—A meeting of the export committees of all the automotive trade associations has been called for April 13 at Washington by Gordon Lee, chief of the automotive division of the Bureau of Foreign and Domestic Commerce. The purpose of the conference will be to exchange ideas on how best to promote sales abroad of American-made automotive products. The advisability of holding periodical meetings of export managers at Washington also will be considered.

The organizations which have been invited to send representatives to the meeting include the National Automobile Chamber of Commerce, The Motor and Accessory Manufacturers Association, the Society of Automotive Engineers, the Motorcycle and Allied Trades Association, the Aeronautical Chamber of Commerce, the National Association of Motor and Engine Manufacturers, the National Association of Motor Truck Industries, the Association of Automotive Equipment Manufacturers and the Class Journal Co.

International 1921 Profit, $4,149,000

Was Derived Entirely from Foreign Trade—Gross Sales Declined

CHICAGO, April 3—The International Harvester Co. for 1921 reports gross sales of $121,215,000, a reduction of 46 per cent from the total for 1920. The net profit for the year was $4,149,000, compared with $16,655,300 the year before. The business done in this country produced no profit, says the report, the profit shown having been derived entirely from the company's foreign trade.

The net profits for the year fell far short of dividend requirements, which called for cash payments of $4,215,673 on the preferred stock, $5,112,786 on the common stock, and $3,645,414 for stock dividends. These amounts, less the profits reported, were charged to the profit and loss surplus, which reduced the account to $59,526,787 at the close of 1921, compared with $68,350,741 at the end of 1920.

Current assets were listed in the balance sheet at $179,554,282 and current liabilities at $27,507,540, leaving net working capital of $152,046,742. The assets included: Inventories, $114,085,765; accounts receivable, $56,283,380; investments, $823,484, and cash, $8,361,651.

Harold F. McCormick, president of the company, in his remarks to stockholders, said that the year 1921 was the "worst in the history of the agricultural implement business." Continuing, he stated:

Shipments to Russia

Notwithstanding the conditions adverse to foreign trade, the volume of the company's business abroad in 1921 compared much more favorably with 1920 than did the business in the United States. During the year the company sent machines to Russia, receiving the entire purchase price of approximately $1,600,000 in United States money. This is the first transaction of this kind in some years. Substantial shipments were made to Poland, credit being granted for part of the purchase price under guaranty of the Polish Government.

Representatives of the company visited the works at Lubertzy, near Moscow, Russia, during the fall of 1921. The Russian works have not been nationalized and have been continuously under the management of the company's employees. The property is reported to be in excellent condition. Agricultural machinery is being manufactured there and distributed to the Russian trade.

McCormick in his remarks in general said that the "rapid and severe decline during that period in the price of practically all farm products greatly diminished the purchasing power of the farmer and had a depressing effect upon the implement business, which is dependent for its success upon the prosperity of its ultimate customer—the farmer."

Company Returns to Kentucky

LOUISVILLE, March 30—The return of the International Harvester Co. to Kentucky will be marked by the opening of bids on the new office and warehouse building, to be erected here. The company moved its Louisville plant to New Albany about eleven years ago, following the enactment by the Kentucky Legislature of several anti-trust laws. Since then, however, the laws have been modified or repealed, and the officials of the company were induced to bring the plant back to Louisville.

J. L. Gardner, general manager of the New Albany factory, states that the cost of the building is uncertain. It will have a frontage of 174 ft. and will be four stories high. The floor space will amount to 70,000 sq. ft.

$250,000 Back Royalties Awarded to Inventor

MINNEAPOLIS, April 3.—R. B. Hartsough of Minneapolis has been awarded more than $250,000 in back royalties and interest on the "Happy Farmer" tractor, in a suit begun in 1919 in the Federal court for western Wisconsin and carried through to the Circuit Court of Appeals for the Seventh District, sitting in Chicago. The suit was brought against Albert Hirschheimer, of La Crosse, and others.

He claimed to have designed the tractor and to have built it in small quantities prior to 1915, when he entered into agreement with the defendant whereby the latter received the manufacturing privilege and was to pay Hartsough on the basis of 3 per cent on the retail selling price of each machine. It was alleged that Hartsough was induced in 1916 to cancel his contract, following which Hirschheimer reorganized the company and resumed manufacture as the La Crosse Tractor Co. The contract is restored and the cancellation set aside by the court action.

Charge of Auto Stores' Head Not Sustained

PHILADELPHIA, April 3—Albert E. Williamson, Boston, and Adolph Maymayer, Brooklyn, whom Edward B. P. Carrier, president of the bankrupt United Auto Stores, Inc., had arrested for alleged conspiracy to wreck the concern, have been discharged by a magistrate.

The former head of the Auto Stores charged that Williamson, whom he had brought in to reorganize the United Guaranty Corp., the stock-selling agency for the Auto Stores, and Maymayer, who had been head of the sales force, had thrown the business into a receivership for their own gain. After reviewing the testimony, the magistrate asserted that he found no grounds for holding Williamson and Maymayer.

SANCTIONS AUSTIN PLAN

LONDON, March 17 (*By Mail*)—The High Court has formally sanctioned the plan of the creditors of the Austin Co. for the continuance of the business on approved terms. The effect of this decision is to close the protracted litigation affecting the company, to affirm that, in the court's opinion, the company can carry on its business at a profit and to leave it free to do so. The company is reported to be making a fair net profit, the new "Twelve" model having proved a great success.

Translates Balance Sheet for Dealers

Hart-Parr Co. Sets Out Facts So They Can Be Understood Readily

CHARLES CITY, IOWA, March 31—The Hart-Parr Co. has made a departure from the usual method of handling annual financial statements and has translated it into the simplest terms, so that it can be understood readily by distributors and dealers to whom it has been sent.

The balance sheet, as it has been prepared by the Hart-Parr Co., follows:

We have cash in bank	$190,232.23	
Certificates of deposit and miscellaneous notes and accounts (less allowances)....	225,516.74	
Merchandise inventories	515,057.19	
The above total represents our current assets as separated from fixed assets, buildings, etc.....	930,806.16	
This gives us total net quick assets of..		$769,970.19
In addition to the quick assets we have a total investment, (less depreciation) in buildings, equipment and miscellaneous property which we term as fixed assets of	1,326,859.63	
Against these fixed assets we have liabilities of.....	524,597.09	
These liabilities include reserves set up not paid, money owing on buildings, which is being paid off yearly, none of which is past due, and equipment. The net credit balance on fixed assets is.....		802,262.54
This makes a total of net assets of.....		1,572,232.73

This amount of money is the value of the stockholders' investment in the company after paying all obligations. In our assets there is no item of good will, patents or anything else but that is a tangible asset.

Sterling Knight Buys Accurate Machine Plant

CLEVELAND, April 3—The Sterling Knight Motor Car Co. has purchased the $1,000.000 plant of the Accurate Machine Co. here. Engineering and mechanical experiments have been carried on for more than two years by James G. Sterling, vice-president and treasurer of the company, assisted by a number of men who have been with him in other ventures.

The Knight engine has been changed in some respects and the idea of the company will be to build distinctive custom chassis, using this type engine. No price has been set, as the early production will be priced to the particular job.

Washington Active on Trade Body Work

Congressional Committee May Aid in Defining Rights of Associations

WASHINGTON, April 5 — A resolution providing for the creation of a committee to investigate existing conditions of industry and commerce in the United States for the purpose of recommending to Congress legislation defining the rights and limitations of cooperating organizations as distinguished from illicit combinations in restraint of trade, has been introduced by Senator Edge of New Jersey.

A similar resolution has been introduced in the House by Representative McArthur of Oregon.

Outgrowth of Court Decision

This action is the direct outgrowth of the Supreme Court decision in the hardwood lumber case, which left in an exceedingly nebulous state the question of what activities are permissible for trade organizations.

A committee appointed by the Chamber of Commerce of the United States, of which Alfred Reeves, general manager of the National Automobile Chamber of Commerce, is a member, is holding a meeting here today to discuss what can be done to determine definitely the activities in which trade associations may engage.

Secretary of Commerce Hoover has called a conference here for April 12 of representatives of trade associations to consider the compilation and dissemination of statistical information concerning various industries.

McArthur's Resolution

The resolution introduced by Representative McArthur follows:

Whereas the revival of the industrial activities of the United States is essential to the welfare of the individual as well as the nation, and whereas business has been suffering severe depression from which its reconstruction should be stimulated by every legitimate means, and whereas business procedure that will without protecting monopolies, eliminate waste in production or distribution, lower costs, simplify and standardize methods, increase efficiency and the morale of business, is a beneficial factor in economic progress, and

Whereas, Congressional action has already been taken to assist in agricultural co-operative marketing and distribution; and

Whereas, The industrial tendency is toward the substitution of research and scientific business methods and previous uncertainty and ignorance; and

Whereas, business is hesitating because unable to secure guidance, legal or governmental, which will clearly indicate the proper lines of conduct in business association; and

Whereas, business is entitled to know in definite terms what it legally can and cannot do;

A joint committee of Congress be created, to be composed of six members from each branch, whose duty it shall be to investigate existing conditions of industry and commerce in the United States and the markets of foreign countries, insofar as the same directly affect industry and commerce of the United States, including questions as to production, distribution, labor and business methods, and to report to Congress and to suggest such legislation, if any, as it may deem best upon these subjects with special reference to the most effective ways and means to revive industry and to stimulate foreign and domestic trade, to stabilize business conditions as to the future, to minimize the danger and distress of recurring periods of business depression with their resultant cycles of general unemployment, and to define the rights and limitations of co-operative organizations as distinguished from illicit combinations in restraint of trade.

Lincoln-Ford Company Formed for $15,000,000

DETROIT, April 4—The Lincoln-Ford Motor Car Co. has been incorporated in Michigan as a successor to the Lincoln Motor Co. It is capitalized at $15,000,000, all in common stock, of which $250,000 has been subscribed and paid for in cash.

All but three of the 2500 shares of stock already issued are held by Edsel B. Ford. The other stockholders are Henry Ford, Henry M. Leland and Wilfred C. Leland, each of whom holds one share.

Officers of the new company are: President, Henry M. Leland; vice-president and general manager, W. C. Leland; second vice-president, Edsel Ford; secretary and treasurer, W. T. Nash; assistant secretary and treasurer, B. J. Craig. The directors are the Lelands and the Fords. The Lelands continue in the positions they held in the original Lincoln company as does Nash. Craig is secretary of the Ford Motor Co.

It is understood that it has not been determined how the stock of the new company finally will be distributed between the Ford and Leland families.

Ohio Halts Stock Sale by Seven Rubber Firms

AKRON, April 3—Further stock sales by seven Ohio rubber companies with an aggregate capital stock of $12,979,925, have been ordered stopped at once by Arthur L. Stewart, Ohio state securities commissioner. Stewart's action in withdrawing permission for further stock sales, in addition to these rubber companies, affects 23 miscellaneous companies with a total par value for the 30 companies' stock of $17,917,555.

The seven rubber companies whose sale of stock has been stopped by Commissioner Stewart's orders are:

D. & M. Cord Tire Co., Cleveland; Phoenix Rubber Co. of Akron; Glamorgan Tire & Rubber Co. of Orville; Avalon Rubber Manufacturing Co. of Akron; Andes Tire & Rubber Co. Cleveland; Nu-Air Tire & Rubber Co. of Cleveland; Maguire Tire & Rubber Co., Cleveland and Tuscora Rubber Co. of Denver.

Among the miscellaneous companies whose stock sales have been halted are:

Halladay Motors Corp. of Newark; Tuscora Rim & Machine Co. of New Philadelphia; Twin Dry Cell Battery Co. of Cleveland.

Timken Prepares Way for Profitable Year

Readjustment Indicated in Balance Sheet—Inventories and Accounts Payable Cut

DETROIT, March 29—The balance sheet of Timken-Detroit Axle Co. as of Dec. 31 last shows total assets of $19,105,138 as compared with assets of $21,494,864 at the end of 1920. Current assets were $8,350,104 and current liabilities $2,427,301. Net working capital of $5,922,803 compares with $8,762,148 a year ago.

Inventories carried at $10,932,521 have been reduced to $7,258,281. Accounts payable of $3,458,647 a year ago have been decreased to $438,824, a large part of this, $1,950,000, by substituting bank loans for the accounts.

Cash position is $502,986 as compared with $671,151 in 1920. Customers' notes and accounts receivable total $503,064 against $733,278. Marketable securities of $85,772 were added to the assets. Accrued expenses and dividends increased from $36,573 to $38,477. Other assets were $480,276 as against $601,910.

Accumulated surplus was $8,736,737 as against $9,866,662, the difference being accounted for by writing down inventories to market values, payment of dividends at 7 per cent on preferred stock and 2 per cent on common, and the taking of a moderate operating loss on the year.

Outstanding preferred stock was reduced from $4,975,000 to $4,962,700. Outstanding common stock is $2,978,400.

President A. R. Demory says:

We feel we have readjusted ourselves to a position where this year should show a profit. Specifications for immediate delivery of axles have increased very materially. We have acquired some new customers, retained all our old ones, and feel confident that we are in shape to work out this very trying problem and maintain the very strong standing we have always enjoyed. We should end the year 1922 with a very satisfactory showing.

Spicer Reports Profit

NEW YORK, April 3—Spicer Manufacturing Co. for the year ended Dec. 31, 1921, reports an operating profit of $12,674 after administrative and selling expenses and plant depreciation. The net loss, after interest charge deductions, was $435,257, the first to be reported since the formation of the company.

The general balance sheet shows current assets of $5,589,824 and net current liabilities of $1,881,368. The former consists of $4,067,128 inventories; $1,136,842, accounts payable; $80,936, investments, and $304,918 cash. Among the current liabilities are notes payable amounting to $1,321,000.

C. A. Dana, president, states that sales for the first three months of 1922 were approximately double those of the same period last year. Orders are coming in at such a rate at the present time that the company has put on a night shift at its Plainfield, N. J., plant.

April Schedules Call for General Increases

Detroit Plants Will Exceed March Production Figures by One-Third

(*Continued from page* 782)

Hupp Motor Car Corp., with a production in March of slightly over 3000, has scheduled 4000 for April. The March total ran considerably higher than scheduled, and April is also expected to run higher.

Liberty will build about 600 cars in April. March figures after a late start ran higher than 350.

Cadillac, at capacity since the early part of the year, will continue its schedule of about 100 cars daily.

Lincoln has scheduled 750 cars for April, all that the factory in its present state of reorganization can build. Orders already covering production to July 1 are on the books at the factory.

Rickenbacker, with an output of over 300 cars in March, has scheduled between 500 and 600 for April. The factory is now fully equipped to meet production requirements.

Steady Flow of New Business

There is a firm feeling among the sales executives at the factories that steady business in automobiles is assured for at least the summer period. Though the bulk of the demand is from present owners, there is a steady flow of new business from persons without cars to exchange.

Most of the new business is in the big industrial centers, officials declare, with a good demand, however, from the smaller cities and considerable buying in the rural districts. Cities in the Middle West, which were thought to have reached a point where replacement business was for the most part the only business to be expected, are reported showing a surprising volume of first sales.

Toledo Plants Active

TOLEDO, April 3—The Willys-Overland Co. has led all Toledo automotive plants in getting back into large scale production during March. The plant took on 1200 employees during the month and now has a total of 7525 at work.

Milburn and Chevrolet held their own, while many of the accessory plants took on more employees and boosted output.

The Electric Auto-Lite division of the Willys Corp. increased its employees by 300 last week and has about 2000 at work now.

In a recent survey of 130 Toledo plants it was found that 30 were at 100 per cent production, 69 were operating at 75 per cent or better. Many of these were in the automotive group. Malleable iron foundries have shown a big pick-up in production.

The Bock Bearing Co., Doehler Die Casting Co., Bunting Brass & Bronze Co., and many others are among these operating with two or three months orders ahead and with increasing working forces.

The outlook for spring manufacturing is very good.

Trend is Upward

BRISTOL, CONN., April 3—The New Departure Manufacturing Co. is steadily increasing its output and there now are 2300 men on the payroll, an increase for the first three months of this year equal to the increase in the entire previous year. The number now is nearly twice as large as in any pre-war month.

MARYSVILLE, MICH., April 3—C. H. Wills & Co., manufacturers of the Wills Sainte Claire car, announce that February business was 50 per cent over January; the first twenty days of March showed an increase of 60 per cent over February, and April orders already booked give a definite increase in business of 100 per cent over March.

MOLINE, ILL., April 3—The Deere Co., producing tractors and farm implements, has greatly increased its forces and is operating on a basis of five and one-half days a week. Orders on hand will enable the company to maintain the present force and time schedule for several months.

SALEM, OHIO, April 4—Mullins Body Corp. reports that it has received sufficient new orders for its product to increase production to 70 per cent of its plant capacity.

DETROIT, April 4—Kelsey Wheel Co. has contracted with the Ford Motor Co. to supply 360,000 sets of wheels during the current year.

Budd Will Be at Full Capacity for 10 Months

PHILADELPHIA, April 3—The Edward G. Budd Manufacturing Co., maker of all-steel bodies, has enough unfilled orders to keep its plant operating approximately at capacity for the next ten months. Business has been increasing to such an extent that some of the working force is employed at night.

The ratio of high, medium and low-priced bodies being sold is normal. Prices have been reduced about 40 per cent on the average, which has contributed to cuts in the prices of completed motor cars. The majority of medium and high-priced models, according to the company, reaches ultimate consumers in Eastern and Middle Western Cities. Most of the low-priced models are distributed eventually west of the Mississippi. The Budd company is doing no foreign business.

Canadian Shipments 1,442 in January

With Those from United States Total Exports Aggregated 2,871 Vehicles

OTTAWA, ONT., April 3—Export shipment was made during the month of January of 1442 passenger cars and motor trucks from Canadian factories. The details of these shipments have just been issued by the Department of Trade and Commerce and show that the United Kingdom, Australia, Argentina, India, British South Africa and New Zealand were the principal buyers. The figures follow:

MOTOR TRUCKS

To	No.	Value
United Kingdom	32	$13,792
Australia	15	6,856
India	26	11,885
Ceylon	6	2,745
Strait Settlements	12	5,486
Dutch East Indies	3	1,370
Other Countries	4	1,828

PASSENGER CARS

To	No.	Value
United Kingdom	564	$358,599
United States	5	7,240
Argentine Republic	102	62,968
Australia	367	248,156
Brazil	6	2,662
India	115	76,388
British East Africa	8	2,766
British South Africa	45	35,741
China	10	8,642
Dutch East Indies	15	7,723
Japan	10	8,839
Netherlands	4	2,878
New Zealand	36	32,049
Norway	4	3,698
Siam	2	1,850
Spain	5	5,120
Sweden	12	5,490
Other Countries	34	33,858

AUTOMOBILE PARTS

To	Value
United Kingdom	$131,133
United States	2,907
Argentine Republic	473
Australia	4,992
India	29,470
Straits Settlement	936
British East Africa	4,750
British South Africa	2,118
British West Africa	182
Dutch East Indies	9 621
New Zealand	154
Other Countries	2,187

Automotive exports from the United States during January were 2407 cars and 464 trucks, a total of 2871 vehicles. Thus, combining the United States and Canadian shipments, the overseas trade in January was 4313 automotive vehicles.

"GOVERNOR" BILL KILLED

NEW YORK, April 3—The Board of Aldermen have killed the proposed ordinance to have motor vehicles equipped with a governor to regulate their speed through the city streets. A special traffic committee is framing in its place an anti-speed ordinance.

Equipment Trade Runs Ahead of 1921

Increase of 20 to 40 Per Cent Along Atlantic Seaboard Is Reported

NEW YORK, April 5—Wholesale business in automotive equipment for the past three months of the year has been running 20 to 40 per cent ahead of last year in volume in different sections along the Atlantic seaboard. Jobbers from Maine to the District of Columbia, who attended the meeting of the Eastern Automotive Equipment Association, unanimously reported steadily improving conditions.

Owing to lower prices money volume so far has not been much greater, and in some districts not as great as last year, but it is increasing every day and indications are that April and May will be far better months from a revenue standpoint than the same period a year ago.

The jobbers reported that more than half the territory, at least, was being covered with meetings in the sales promotion campaign, with frequent showings of the "Ask 'em to Buy" film.

A resolution was forwarded to the Automotive Equipment Association in Chicago, suggesting that in future the manufacturing division of the organization should finance the general administration of the sales promotion campaign, inasmuch as the members of the jobbers' division are supporting the local and sectional meetings.

Hudson and Cadillac Export Business Gains

DETROIT, March 30—Hudson export business is showing very satisfactory activity, President Roy D. Chapin said this week. Every foreign agency of the company is reporting renewed interest in automobiles, and shipments are already going forward in a gratifying volume.

The company has increased to some extent its representation in foreign fields and retained all its force through the period of depression. By keeping closely in touch with conditions at all times, Chapin said, Hudson-Essex has been able to reap the early benefits of the return of trade.

Cadillac Motor Car Co. reports a large increase in shipments of parts to foreign territory over last year. In Buenos Aires the increase was 213 per cent; Christiania, Norway, 37 per cent; Geneva, Switzerland, 135 per cent; Havana, 315 per cent; London, 138 per cent; Sydney, 420 per cent, and Utrecht, Holland, 651 per cent.

FORD TO RESUME AT ATLANTA

ATLANTA, GA., April 5—Preparations are being made to resume operations at the Ford assembly plant in this city, in which no cars have been put together in more than a year. Between 300 and 350 men will be given employment. Ford business in the southern states has increased more than 100 per cent in the past 30 days, it is stated. This indicates decided improvement in general business and financial conditions.

TOTAL CARS AND TRUCKS PRODUCED IN MARCH WERE 190 PER CENT OF SAME MONTH, 1921

NEW YORK, April 5—Carload shipments of automobiles and trucks by all makers in March are estimated at 25,000. Production for the month by members of the National Automobile Chamber of Commerce were 135 per cent of February and 190 per cent of March 1921. The factory shipment figures for the first three months of 1920, 1921 and 1922 follow:

	Carloads			Driveaways			Boat		
	1920	1921	1922	1920	1921	1922	1920	1921	1922
January	20,057	6,485	15,241	29,283	3,185	7,397	....	93	154
February	25,505	9,986	19,600	43,719	7,507	9,950	....	99	169
March	29,236	16,287	25,000	57,273	9,939	15,800	....	75	264

Factory shipments for the other months of 1920 and 1921 follow:

	Carloads		Driveaways		Boat	
	1920	1921	1920	1921	1920	1921
April	17,147	20,187	64,634	14,197	....	1,619
May	21,977	18,608	74,286	15,193	....	2,381
June	22,516	20,269	60,746	18,834	8,350	3,947
July	23,082	19,470	52,342	15,320	8,702	3,725
August	23,386	20,350	34,060	14,290	7,095	3,565
September	20,804	20,150	24,431	13,550	5,469	3,580
October	17,209	17,323	14,127	11,257	2,519	2,300
November	13,253	14,061	9,497	10,509	659	1,385
December	11,802	12,100	6,469	7,500	89	134

Carload Shipments Approximate 25,000

(*Continued from page 782*)

While it is not to be expected that the sale of motor vehicles will continue to show such astonishing gains for the rest of the year as compared with 1921, it now can be stated definitely that the volume of business will be larger than last year. Unless some entirely unforeseen obstacles arise to retard the general recovery of the country from industrial depression, truck manufacturers and parts makers are certain to have a materially larger volume of business than they did in 1921.

The only element of doubt is in the passenger car field, and it now appears highly probable that earlier predictions that the volume of sales would not exceed those of 1921, when they approximated 1,500,000, were too conservative.

Within the past few weeks strong impetus has been given to the sale of small and medium sized tractors. This reflects improved conditions in the agricultural sections of the country. The same improved tone has been apparent in the truck market in these districts, and farmers are even showing renewed interest in inexpensive passenger cars.

Dealers in all sections of the country report better business.

High Level Is Reached In Studebaker Sales

13,000 Cars Sold in March — Quarter 100 Per Cent Better Than 1921

NEW YORK, April 3—Sales by the Studebaker Corp. of approximately 22,000 cars for the first quarter of 1922 exceeded sales for the same period of last year by approximately 100 per cent. March sales of 13,000 cars established a new record. The figures were disclosed by President A. R. Erskine upon his arrival here to attend the annual meeting of the corporation.

Improvement General

"New sales records were established in practically every city in the country," he said, "while business from rural sections and export markets showed very much strength and improvement. Production in March was 10,433 cars, a new record, and for the quarter, 26,675 cars, compared with 10,973 last year, an increase of 143 per cent. Stocks accumulated during the winter for the spring trade rapidly diminished in March and will be fully absorbed in the second quarter."

Retail sales figures for March in the following cities were given out by Erskine: New York, 1282; Newark and vicinity, 678; Chicago, 538; Detroit, 306; Los Angeles, 261; Cleveland, 184; Milwaukee, 145, and South Bend, 106.

New Director Chosen

C. L. Bockus was elected a director to succeed the late A. Barton Hepburn.

Erskine stated that the possibility of the payment of a stock dividend on Studebaker common stock has not been discussed by the directors. The dividend meeting is scheduled for April 29.

Men of the Industry and What They Are Doing

Henderson Leaves Martin-Parry

R. P. Henderson, since 1916 associated with the Martin-Parry Corp., has resigned as vice-president of that corporation and has moved from Indianapolis to Detroit. Two years after his association began, the success of the body builders attracted the attention of eastern capitalists to the importance of commercial bodies as offering an independent and profitable line of production, and as a result the Parry plant at Indianapolis and the Martin plant at York were taken over and operated under the name of Martin-Parry Corp. with Henderson as vice-president in charge of sales. Before taking up his work with the corporation, he was connected with the Cole Motor Car Co., of which he was a director. In 1913, following the successful coast to coast highway tour staged by the Indiana Automobile Manufacturers Association, Henderson was elected to the presidency of that organization.

Hannum and Nephler on Tour

George H. Hannum, president and general manager, and C. J. Nephler, general sales manager, of the Oakland Motor Car Co., have left for a three weeks' tour of the Pacific Coast, visiting the principal Oakland dealers and distributors and Oakland branches. In the course of the trip they will visit their recently created branch at San Francisco, which was changed from a distributorship.

Vail Reconsiders Resignation

At the request of the Waltham Watch Co., E. L. Vail has reconsidered his resignation at head of its automotive equipment division and has signed a contract covering a period of years as manager of the division. He will have immediate supervision over sales and service in that department. Vail practically created and developed the business of the company on Waltham automobile clocks and, later, introduced the Waltham speedometer. Retaining Vail's services is indicative of the company's plans to strengthen further and build up its automobile clock and speedometer business.

Jacobson Forms Rico Ignition

Edward B. Jacobson has severed his connection with the J. & B. Manufacturing Co., Pittsfield, Mass., and has organized the Rico Ignition Co., that city, to handle a full line of ignition specialties. Jacobson's entrance in the industry dates back twenty-seven years, when he began in the ignition business in Boston. Seven years later he moved to Pittsfield and continued to figure prominently in the trade of the country. He was instrumental in starting the Pittsfield Spark Coil Co. as well as the J. & B. company. Until recently he served as president and engineering expert in the latter organization. His assistant in the new enterprise, in charge of selling operations, will be Charles A. Mattison, who has been associated with the Pittsfield Spark Coil Co. for the last eighteen years. The company is beginning business with an initial order for 5000 sets of ignition.

Hildebrand Leaves Branch

C. C. Hildebrand, after serving as manager of the Minneapolis branch of the Ford Motor Co., has resigned to take up his residence in Hollywood, Cal., where his family has been living this winter. He will rest for a time before resuming active work. Upon his departure his employees presented him with a platinum set diamond ring and the dealers with a Lincoln car. He was also a guest at a dinner given by the road men. Hildebrand is one of the veterans of the industry. For two years he was associated with the Chalmers company as assistant general manager and for eight years served as sales manager for the Stevens-Duryea. Prior to that he was connected with the bicycle business. He is succeeded by S. A. Stellwagen, formerly manager at Omaha.

Church, Consulting Engineer

H. D. Church of Fairfield, Conn., formerly a chief engineer of the Packard Motor Car Co. and later vice-president of engineering of Hare's Motors, Inc., is now at work in a consulting capacity on several interesting engineering developments. A medium weight six-cylinder model, embodying advanced features of design, was completely developed by Church as vice-president of Hare's. It is understood his present activities include work upon another new light model. His services now are available as consulting engineer.

Marvin at Hot Springs

J. L. Marvin, assistant general manager of the National Automobile Chamber of Commerce, has been prevailed upon to go to Hot Springs, Va., to recuperate from an attack of influenza.

Dawson Assists Campbell

C. E. Dawson, who was formerly sales manager of the Chevrolet Motor Co. of Michigan, has been appointed assistant to Colin Campbell, general sales manager of the Chevrolet Motor Co. M. D. Douglas, previously sales manager at Flint, has been named to succeed Dawson in charge of factory sales activities.

Markle Handles Rickenbacker

Lafayette Markle, formerly identified with Olds, Buick and Studebaker retail sales in Chicago, and later serving as vice-president of the Republic Truck Co. and president of the Oneida Truck Co., has taken over the Rickenbacker franchise in Chicago.

Lagow Represents Hupp

Roger M. Lagow has been appointed factory representative of the Hupp Motor Car Corp. for South and Central America. A graduate of Indiana and Harvard universities, he traveled in Europe for several years before returning to this country as a professor of Romance languages at several colleges. His ability to speak fluently several languages convinced him that his opportunity awaited him in the business field. He has also had a diversified experience in business.

White in Own Company

C. M. White, Jr., for the last four years sales manager of the Firestone Steel Products Co., Akron, has resigned to organize White & Co., Inc., of which he is the president. The company, which will market several lines, including crude rubber, fabric, pigments, etc., and will cover the automobile and rubber trade, will have its headquarters in the Flatiron Building, Akron, and later will establish branches in New York and Chicago. The personnel of the company consists of men well known in the automotive and rubber industries.

A. G. Partridge Joins Goodrich

A. G. Partridge, who resigned recently as vice-president and general sales manager of the Star Rubber Co. of Akron, has been appointed special sales representative for the tire division of the B. F. Goodrich Co. Partridge was for many years vice-president and general sales manager of the Firestone Tire & Rubber Co., resigning a year ago to join the Star organization.

Sherratt in Charge at Pittsburgh

G. F. Sherratt has been appointed manager of the Pittsburgh office of the Chain Belt Co. and will be in charge of all the company's chain and engineering business in that territory.

Neill Goes to Texas

V. H. Day, general sales manager of the General Motors Truck Co., supervised the opening of a new direct factory branch in Dallas, Texas, Saturday. The branch will be under the direction of H. A. Neill, who has been manager of the Philadelphia branch and who recently was connected with the factory sales department. Howard Parks, who has been selling G. M. C. trucks in Texas, will be associated with Neill. Pierre Schon, direct factory wholesale representative in the Southwestern territory, will continue in that position.

G. M. INSURANCE BRANCH

NEW YORK, April 3—The General Exchange Corp., a subsidiary of the General Motors Corp., has been organized to carry fire and theft, liability, property damage and collision insurance for owners of automobiles.

Tire Makers Govern Production by Sales

Will Not Pile Up Inventories of Finished Goods—60-Day Supply

AKRON, April 1—Akron tire manufacturers have stopped expanding finished goods inventories, and are applying production direct to sales. Every company in the city has an inventory of about the right balance, with at least a 60-day supply of tires on hand.

In the application of production direct to sales many companies are shipping out tires which are wrapped and loaded in freight cars while still warm. With expansion of inventories no longer necessary, Akron companies are pursuing a "hand-to-mouth" policy, letting production fluctuate and be governed entirely by sales. This is resulting in brief spurts and slumps in tire building, layoffs of men for a few days, and rehiring of these and the employment of many more for brief periods.

Never again, manufacturers say, will they be caught, as they were in 1920, with a huge surplus of tires on hand. Scarcely a company has an inventory exceeding a 60-day tire supply based on normal sales, although a 90-day supply is not considered excessive.

The biggest improvement in the tire industry has been in export trade. For many months a losing proposition for all Akron companies, export business has been re-established upon a profitable basis this year and heavy export orders now are being turned out.

Committee Will Decide Best Course for Parenti

BUFFALO, April 5—A committee representing the creditors of the Parenti Motors Corp. has been formed to decide what will be the best course to pursue with respect to the future of the company. This committee now is studying the situation and will report in a short time.

At the first meeting it was suggested that two courses were open. One would be the appointment of a trustee to take over and adjust the affairs of the company and the other would be an attempt to raise enough money through the sale of cars to enable the company to continue in business. It was stated at the Parenti plant that the company has about 100 cars about 60 per cent completed.

N. A. D. A. APPOINTS SHAW

ST. LOUIS, April 5—Lynn M. Shaw, secretary of the Indiana Automotive Trade Association, has been appointed an assistant general manager of the National Automobile Dealers Association. Prior to his connection with the Indiana organization, Shaw served as secretary of the Youngstown Automobile Dealers Association and previously acted as assistant general manager of the Elton Motors Co., Cadillac distributor for the Youngstown territory.

RADIO TO TRANSMIT ROAD CONTEST RULES

WASHINGTON, April 5—Messages extending an invitation to all high school pupils to participate in the national essay contest on highway economics will be broadcasted from here to-morrow evening by radio telephone.

The apparatus owned by the Postoffice department will be used in sending out the information as to the rules of the contest, inasmuch as this Federal department acknowledges that delivery of rural mail depends upon the improvement of highways throughout the country.

The contest is under the auspices of the highway and highway transport educational committee.

Holders of Chalmers Notes Form Committee

(*Continued from page* 784)

to-day that the default in the payment of interest on the first mortgage notes of the Chalmers company, while primarily to conserve working capital, also will have the effect of bringing the actual situation confronting Chalmers to the attention of noteholders and creditors so that some constructive action can be taken.

Notice was given to bankers and creditors, Hutchinson said, of the intention to default payment so that no undue alarm should have been occasioned. He added that the position of the Maxwell Corp. had been set forth clearly. It holds a mortgage of $3,150,000, which will fall due in October and which Chalmers will not be able to pay under present conditions.

As a preliminary to a refinancing program for Chalmers, the entire situation will be placed before those financially interested in the affairs of the two companies. As a reassurance to Chalmers creditors, Maxwell has agreed to take over all purchase commitments pending a decision on what action shall be taken.

Hutchinson took pains to explain that Maxwell is acting only in the interest of its subsidiary, and that its own financial and manufacturing programs are in no way concerned.

HARLEY CO. SUED ON NOTE

SPRINGFIELD, MASS., April 5—Harry Tatnell of Philadelphia has brought suit against the Harley Co., A. W. Morris of Springfield and R. E. Northway of Natick for a breach of contract. An attachment for $100,000 on the Harley plant has been filed at the registry of deeds. The basis of the action is alleged non-payment of a note.

Further Price Cuts in Britain Unlikely

Manufacturers Say They Are Doing Business on Narrow Margin of Profit

WASHINGTON, April 1—No reduction in price of British motor vehicles is expected at the present time, according to reports received by the Automotive Division, Department of Commerce, from the American Trade Commissioner in London. British manufacturers insist that they are still doing business on a narrow margin of profit despite the low cost of labor and raw materials, and therefore cannot cut their selling price. The export trade of the British automotive manufacturers is very small and as its contracts run out no repeat orders are coming in.

There has been a fairly steady continuance of demand for small cars and motorcycles accompanied by virtual stagnation of the large car lines. Manufacturers of motor trucks have been inactive and little improvement is anticipated until the surplus war stocks have been cleared.

Under the new licensing plan purchasers of motor vehicles may take out licenses for one or more quarters of the year. Thus with the lapse of the quarter ending March 31, increased business is expected from purchasers who are not willing to pay the first three months' portion of the pound per horse power per annum tax.

Carter Product Planned to Compete with Ford

WASHINGTON, April 4—The Carter Motor Car Co. reports that while drawings of the car it proposes to make at Hyattsville, Md., have not been completed, it will be designed to compete with Ford.

The company's personnel includes: President, A. G. Carter, for the past 10 years president of the Washington Motor Car Co.; vice-president, H. J. Hogan, formerly with the Lorraine Motor Car Co.; treasurer and general sales manager, Major C. W. Search, formerly with the Jeffries Motor Car Co., and former sales manager of the Northway Motors Co.; general manager, F. L. Carter, formerly treasurer of the Washington Motor Car Co.

NATIONAL AGREEMENT LIKELY

INDIANAPOLIS, April 4—No date has been set as yet for a hearing upon the application filed by the Columbia Axle Co. for the appointment of a receiver for the National Motor Car & Vehicle Corp. It now is considered probable that the application will be withdrawn, inasmuch as a satisfactory agreement is likely between the creditors' committee, which is managing the National factory, and the axle company.

California Reports 70 Per Cent Growth

Truck Sales to Fleet Owners Feature Conditions in Northern Section

SAN FRANCISCO, April 5—Sales of passenger cars for northern California for the first quarter of 1922 are at least 70 per cent better than they were one year ago, and more than 50 per cent better than they were two years ago. Sales of motor trucks to fleet owners, and the establishment of truck fleets in the smaller towns, show nearly 100 per cent gain over the first quarter of 1920, but sales of trucks to individual owners, for their own uses, have not kept pace with fleet sales, and are not more than 50 or 60 per cent better than in the same period of 1920.

Automobile sales in California for February, 1922, were 254 per cent higher than they were for February, 1921. In February of this year the dealers of California sold 8159 cars, while in February, 1921, they disposed of only 3213 cars. The 47 counties of northern California are credited with 3298 sales in February, 1922, as compared with 1310 sales in the same month of 1921. The eleven counties of southern California show 4861 cars sold in February, 1922, against 1903 for February, 1921. Trucks to the number of 1075 were sold in California during February, 1922.

During February, 1922, the registrations for the entire state were 9234, as compared with 6694 in January, 1922, a gain of 2540. In Alameda county, in which is located the city of Oakland, and which holds a high record for automotive vehicle and equipment sales, 656 cars were sold in February of this year, compared with 463 in January, 1922.

Dallas Sales Increase

DALLAS, TEX., April 4—The retail automobile business in Dallas for March was as good as that for January or March, or for the three last months of 1921. Actual sales and deliveries were said to be slightly above those of February, partly because of the influence of the recent spring show.

The truck business was about up to the previous months. The tires and accessories showed some improvement, probably due to the approach of spring and the preparations for using cars which have been housed for a good part of the winter.

The tractor and trailer trade was rather slow, though there were some tractors moving to the farming belts in the Panhandle and the rice sections of southeast Texas.

MERGER RUMORS DENIED

NEW YORK, April 5—The sensational rise of the past few days in automotive stocks has brought numerous rumors in the financial district of impending consolidation. One of these was a revival of the old report that Mack Trucks, Inc., and the White Co. would combine. Another was that the management of the Pierce-Arrow Motor Car Co. would be taken over by C. W. Nash preparatory to a merger with the Nash Motors Co. Both these reports were emphatically denied.

IMPROVED BUSINESS REACHES OUT TO MAY

NEW YORK, April 3—The end of March brought no slackening in the business improvement reported in steadily increasing volume by parts manufacturers since Jan. 1. Practically all manufacturers have sufficient orders booked for April to insure a better month than March. Still more gratifying is the fact that many of them have received substantial commitments which will carry them through May.

Early in March there was considerable speculation among parts makers over the prospects after April, but developments in the past two or three weeks have made it certain that there will be no slackening in operations for another two months at least.

The number of parts plants in which operations exceed 50 per cent of capacity is increasing steadily, and a considerable number have been compelled to put on night shifts.

Throughout the parts branch of the industry the moderate optimism which has prevailed for the past three months is approaching a feeling akin to enthusiasm.

Springfield Factories Report Better Business

SPRINGFIELD, OHIO, April 4—Orders from France and Australia are being filled at the Springfield works of The International Harvester Co., Charles H. Smart, superintendent, states. The motor truck business is brisk at this plant, good sized orders having been received recently from foreign countries and various points in the United States. The plant is continuing its production schedule of 50 trucks daily. The force has been increased within the last week.

Motor truck business for March at the plant of The Kelly-Springfield Motor Truck Co. was the largest of any month during the past two years, General Manager E. O. O'Donnell says. A gradual improvement in business conditions is noted in reports received by the company from various parts of the United States.

"The first quarter of this year showed an increase of 100 per cent in business over the same period in 1921," said Karl A. Heinzen, advertising manager of The Westcott Motor Car Co., in speaking of the business of this company. "Orders on hand are twice as large as they were at the same time last year."

More Good Reports Received by N.A.C.C.

All Sections of Country Except Dakotas Share in Better Business

NEW YORK, April 6—Directors of the National Automobile Chamber of Commerce, highly gratified at the business done by the industry since Jan. 1, received additional encouraging reports at their monthly meeting here yesterday. These reports were contained in telegrams from distributors in all sections of the country, which stated that business ranged from "good" to "excellent" everywhere except in the Dakotas, where there have been heavy snows.

The manufacturers were told that the used car situation is clearing up rapidly because there is a good demand at the low prices which have been fixed. The decline of prices in the market has been comparable to the reductions in the cost of new cars. The agitation on the subject of used cars has resulted in dealers using greater care in trading, making it possible for them to sell at a profit.

Credit Conditions Easy

Credit conditions are easy everywhere. There appears to be plenty of money for all legitimate enterprises. It was reported that one New York bank believes the present automobile sales season will be the best for two or three years.

While the manufacturers naturally are greatly pleased with the upturn in business, they are not unaware of the fact that the industry now is in the midst of its spring trade and that sales cannot be expected to continue on the present basis after June 1. It is felt, however, that with the present bullish stock market, with general business conditions much better, with exports improving and with foreign exchange rising, business for the last half of year should be good.

The Essex Motor Car Co. was elected to membership in the chamber. It will be represented by Roy D. Chapin.

Alfred H. Swayne and George M. Graham were delegated as counsellors to attend the annual meeting of the Chamber of Commerce of the United States at Washington in May.

The directors sanctioned a meeting of the advertising managers in conjunction with the June convention of the Associated Advertising Clubs of Milwaukee.

J. Walter Drake and General Manager Alfred Reeves will represent the N. A. C. C. at a conference called by Secretary Hoover on April 12 to discuss trade association activities.

The next meeting of the directors will be held in Detroit, May 3.

GREATER FIRESTONE OUTPUT

AKRON, April 5—Announcement is made by the Firestone Tire & Rubber Co. that its production has been increased to 20,000 tires a day compared with 17,000 two months ago.

New European Cars Arriving in Japan

Agencies Giving Up American Products Because of Higher Horsepower Rating

TOKIO, March 2 (*By Mail*)—The approach of the end of the fiscal year has brought several Government departments into the field for new motor transportation. The Electric Bureau of Tokio has just purchased three new repair wagons. These will be mounted on the Packard EC chassis, with full electric equipment and solid tires, and the bodies will be of the modified bus type, capable of carrying 16 mechanics and considerable equipment. The Department of Communications, which is the largest user of motor transportation in Japan—with the exception of the Army—will soon be on the market again.

The local passenger car market remains very depressed. Sales are confined almost entirely to the smallest and lightest of the European light cars, and the popular choice centers on those cars having a taxation rating of less than 10 horsepower. Consequently American cars are not being sold, and agencies for them are being given up. In contrast, every week sees the arrival of some new European car.

German makes are again appearing, and Benz, Mercedes, Protos, Cyclonen and the Austrian Daimler and Fiat are all represented in the Tokio district.

Moline Plow Forecasts Early Reorganization

NEW YORK, April 5—Managers of the reorganization committee of the Moline Plow Co. have addressed a letter to stockholders and creditors explaining the delay in consummating the plan of reorganization. They say that the co-operation of the Willys-Overland Co., which owns 82 per cent of the common stock, could not be obtained because of that company's failure to obtain the consent of its preferred stockholders. The delay of the Willys-Overland was said to be due to pressure of other important matters.

The statement adds that the Willys-Overland Co. has submitted the question to the preferred stockholders, and that the reorganization plan has been recommended by its new board of directors. The managers of the reorganization committee say they feel confident that they "will secure early action in consummating the plan and the proper papers and notices are being prepared to that end."

PYRENE IN NEW PLANT

NEWARK, N. J., April 4—The Pyrene Manufacturing Co., Inc., has moved into its new factory at 520 Belmont Avenue, this city. The building is of thoroughly modern fireproof construction. The general offices formerly located in New York and all manufacturing departments will now be located under one roof. To improve, if possible, the service rendered customers, the company has installed a department for the sale of a complete line of safety devices, as well as the long line of fire fighting appliances.

REO DELIVERS CARS FOR FOILING BANDITS

LANSING, April 5—The Reo Motor Car Co. has delivered to the Adams Express Co. 14 chrome steel lined cars for its bandit-proof New York delivery service. These cars are the first of an order for 100. The enclosed body has specially closed windows and a windshield which is proof against 45-caliber steel jacketed bullets. Each car has eight portholes for automatic rifles. A lever in the rear makes it possible for a guard to stop the car should the driver be injured. The cars were built after the design of W. M. Barrett, president of the Adams company.

Durant Balance Sheet Shows No Liabilities

NEW YORK, April 5—A balance sheet as of March 31, 1922, issued by Durant Motors, Inc., shows that the company has no liabilities. The principal asset consists of participating contracts amounting to $20,988,000, representing the company's proportion of earnings of its associate companies valued on a basis of three years net profits conservatively estimated.

Other assets are: furniture, fixtures and equipment, $44,599; investments and advances to allied companies, $2,594,130; marketable securities, $4,225,902; cash, $3,028,747; notes receivable, $2,260,543; accounts receivable, $242,560; materials and supplies, $108,917. This makes total assets of $12,505,398, not including the participating contracts.

NEW TEMPLAR SALES MANAGER

CLEVELAND, April 5—Morris Bleiweiss has been named sales manager of the Templar Motor Co. to succeed Paul E. Ryan, who retired from the position on April 1. Bleiweiss went to Templar Motors as assistant factory manager two months after the company started production in 1917. He was promoted to service manager and assistant sales and advertising manager before being named to his present position. Ryan was formerly sales manager for the Aluminum Castings Co. He entered the employ of Templar last May. Templar has increased production since Jan. 1.

WILLS REACHES CAPACITY

DETROIT, April 5—C. H. Wills & Co. will build about 50 Wills Ste. Claire cars daily in April, which will be practically the plant capacity. This is an increase of about 75 per cent over March.

Peru and Australia Have Increased Tax

Former Will Use Revenue for National Defense—Latter for Maintaining Roads

WASHINGTON, April 3—Reports received by the automotive division, Department of Commerce, show that two foreign countries have increased taxes on motor vehicles. This added burden has a tendency to increase the sales resistance for American exporters in Peru and Australia.

Commercial Attache W. E. Dunn advises that the Peruvian Government has raised the ad valorem duty on motor cars 1 per cent when the price does not exceed Lp. 500, and 2 per cent on automobiles and carriages when the price exceeds this amount. In addition, an internal tax will be levied amounting to Lp. 1 for Ford cars for hire, Lp. 2 for other cars for hire and Lp. 5 for private cars, in accordance with a law which was put into effect on Jan. 25, 1922. This tax will be levied only on cars actually in use and but once. The funds obtained from these assessments will be dedicated exclusively to national defense.

The American Trade Commissioner at Melbourne has informed the division that a horse-drawn vehicle tax has been proposed which it is estimated will be assessed upon 200,000 vehicles in the State, and an increased registration tax amounting to 5s per hp. on motor cars, and 2s 6d per hp. on motorcycles.

Show in Mexico City Assured Many Exhibits

MEXICO CITY, MEXICO, March 31 (*By Mail*)—Applications for space reservations for the automobile show which is to be held in the National Theater, here, April 16 to 23, inclusive, are coming in rapidly and already it is assured that the exhibit will far exceed that of the first automobile show given here last year.

It is stated that up to March 18 space had been reserved for displaying thirty different makes of passenger cars. These are principally of American make, but there are three European manufacturers who have secured floor space through their local representatives. The European cars are the Fiat, Mercedes and Renault.

A department has been reserved for trucks and tractors, as was the case last year. These are all of American make. There will be exhibits of lubricants and automobile accessories, but no tires.

FORD VIEWS SUIT LIGHTLY

DETROIT, APRIL 3.—The Ford Motor Co. announces that it does not take seriously the suit filed by Edward S. Huff in Florida to recover $11,000,000, alleged to be due on magnetos. The Ford company says it knows nothing of Huff.

Makers of Electric Vehicles Hold Show

Cars, Trucks and Equipment Exhibited—New Design Shown of Taxicab

NEW YORK, April 3—The second annual show of electric vehicles and equipment is being held this week at the building of the New York Edison Co., this city. The two branches of the electric vehicle industry are almost completely represented, trucks being shown by seven makers and passenger cars by three. In addition, the show comprises exhibits of storage batteries, battery charging equipment, charging plugs, meters, lubricants and motor wear.

Few New Technical Features

There is not much new in a technical way in either electric trucks or passenger cars. These vehicles have been standardized by the different makers and factory changes are made only at rare intervals. In connection with the trucks the most interesting study is that of the drive employed on the various designs.

With electric propulsion, efficient transmission is of the highest importance, because the radius of operation of the vehicle depends upon it, but the designers evidently do not agree as to which is the most efficient drive, for practically all forms of drive are represented. Steinmetz uses the bevel and spur gear or double reduction drive, and Walker commercial truck the internal gear balanced drive with the driving pinion on the axle shaft in the one case and the armature shaft in the other, and two opposite intermediate gears meshing both with the pinion and the internal gear on the wheel; Ward uses the worm drive; Walter the regular internal gear drive and O-B and Lansden the chain drive.

Among the passenger cars the most recent design is the Electrocar, which is shown in taxicab form. This has the battery carried in an underslung cradle, instead of divided between the seat and the front compartment, as is usually the case in electric passenger cars.

Battery charging outfits for the most part comprise either a motor generator or rectifier and a charging panel. The charging plugs for electric vehicle charging and storage battery charging in general have been standardized.

Electric Trucks to Be Shown

Next week there will be a show of industrial electric trucks at the same building, at which six manufacturers will show trucks and tractors. Material-handling equipment will also be exhibited.

In connection with the show the second annual electric vehicle luncheon was held at the Hotel Astor on April 4. Arthur Williams, president of the New York Edison Co., acted as toast master, and addresses on the use of electric commercial and industrial trucks in various lines of industry were made by Robert Cowie, vice-president of the U. S. Railway Express Co.; F. H. Hotchkiss, who represented Gerson Marks, assistant to the general manager of the N. Y., N. H. & H. R. R., and J. E. Dann, president of the Pilgrim Laundry.

Cowie said that of all the vehicles purchased by his company for the metropolitan district the past year, 83⅓ per cent were electric vehicles. He had signed orders for no less than 104 such vehicles during the past month. He claimed that owing to the increasing congestion the electric vehicle had all the speed that could be used and that was safe in such a district. Another feature in their favor, he said, was that comparatively small stocks of repair parts sufficed. Cowie mentioned that his company still had in service throughout the country 17,500 horse-drawn vehicles.

FINANCIAL NOTES

Winther Motors, Inc., reports that there is about half of the stock authorized at the time of the consolidation last year issued and outstanding. The company is a result of the consolidation of the Marwin Truck Corp. and the Kenosha Wheel & Axle Co. with the Winther Motor Truck Co. under the name of Winther Motors, Inc. The consolidation was made purely as a matter of convenience and economy in operation. It has an authorized capital stock of $1,000,000 preferred stock and 600,000 shares of no par value common stock.

Marlin-Rockwell Corp. and subsidiary companies' consolidated balance sheet as of Dec. 31, 1921, shows cash on that date as $415,883 and, for the previous year, $544,413. Notes, trade acceptances and other accounts receivable were $305,832 in 1921 and $1,065,370 in 1920. Among the liabilities the notes and accounts payable, government taxes, etc., aggregated $1,783,139 as against $1,591,342. The earned surplus was $2,313,862 compared to $6,862,099.

Black & Decker Mfg. Co. has declared a dividend for the first quarter of the year at the rate of 8 per cent on the preferred stock. The company reports that sales two weeks ago were more than for any week for twenty-two months. It set its sales quota for 1922 $500,000 higher than its actual sales last year and for the first quarter has made 100 per cent of this quota.

Moon Motor Car Co. directors have declared the regular quarterly dividend of 1¾ per cent on preferred stock outstanding, payable April 1, 1922.

PEERLESS ASSETS LARGE

CLEVELAND, April 6—The annual report of the Peerless Truck & Motor Corp. as of Dec. 31 shows current assets of $7,065,665 against current liabilities of only $825,682. The surplus at the close of the year was $5,257,880. The income from sales was $12,055,904 and the cost of sales was $12,103,636, leaving a net loss of $47,742 on this item. The entire net loss for the year was $103,665.

STEWART-WARNER RE-ELECTS

RICHMOND, VA., April 5—Directors of the Stewart-Warner Speedometer Corp. were re-elected at the annual meeting of stockholders.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

Last week's advance in call money rates was attributed largely to temporary conditions, such as government withdrawals from local institutions and disbursements of April 1. Call loans covered a range during the week of 4 per cent to 5½ per cent, in comparison with a range of 3½ per cent to 5½ per cent in the previous week. For fixed date maturities little change was noted, and the volume of transactions was small. Sixty and ninety days and four months' maturities were quoted at 4½ per cent, and five and six months' maturities at 4½ per cent to 4¾ per cent, as compared with 4½ per cent for sixty days and 4½ per cent to 4¾ per cent for all other maturities in the previous week. The prime commercial rate remained unchanged at 4½ per cent to 4¾ per cent.

The Federal Reserve statement as of March 29, 1922, showed a decrease of $1,348,000 in gold reserves and a decrease of $1,231,000 in total reserves. Total bills on hand increased $34,691,000 and total earning assets $33,387,000. There was an increase of $30,553,000 in total deposits and a decrease of $1,531,000 in Federal notes in circulation. The reserve ratio decreased from 78.4 per cent to 77.8 per cent.

The following increases were noted in the statement for the New York institution: $34,198,000 in total reserves; $17,980,000 in total bills on hand; $3,818,000 in total earning assets and $39,596,000 in total deposits. Federal Reserve notes in circulation decreased $70,000. The ratio of total reserves to deposit and Federal Reserve note liabilities combined, remained unchanged at 86.7 per cent.

The Federal Reserve Bank of Chicago has reduced its rediscount rate on all classes of paper from 5 to 4½ per cent, effective as of March 25.

A decrease in the total number of commercial failures was shown last week as compared with that of the previous week. Dun reports 511 insolvencies last week as compared with 544 in the previous week and 299 during the corresponding week in 1921. Failures decreased in all sections of the country, with the exception of the Pacific Coast, where an increase was noted.

DURANT BUYS TIRE STOCK

AKRON, OHIO, April 5—Frank A. Seiberling, president of the Seiberling Rubber Co., announces that W. C. Durant heads a syndicate of 15 men, each of whom has subscribed for $50,000 of Seiberling stock on a basis of 40 per cent preferred and 60 per cent common. This completes the Seiberling financing.

EDWARD P. MAGUIRE DIES

HUDSON, MASS., April 4—The death is announced of Edward P. Maguire, general manager of the Lapointe Machine Tool Co. since 1914 and associated with the business for many years before.

INDUSTRIAL NOTES

Republic Rubber Corp. reports, through its receiver, C. H. Booth, that shipments in March to the 25th were 40 per cent greater than for the corresponding February period and that the carry-over into April will be fully 75 per cent greater than from February into March. The company is producing inner tubes at a rate but slightly under the highest rate of output ever attained in its history. The Youngstown plant is operating only in its solid truck tire department but capacity is being approached at the Canton works which will mean the resumption of pneumatic tire production at Youngstown. Pneumatic tire production is in excess of 1,000 a day. None is made except against firm orders, the company declining to stock tires.

Sandvik Steel, Inc., has consolidated its general steel and steel belt conveyor departments in suite 2001, Woolworth Building, New York, with the following executive officers: President and general manager, W. D. Thomas, formerly manager of New York export sales of the American Rolling Mill Co.; vice-president, Anders Johnson, formerly staff engineer, conveyor department, Sandvikens Jernverks Aktiebolag, Sandviken, Sweden; secretary, Garrick M. Spencer; sales manager, Harry Carlson, formerly vice-president and general manager of American Galco, Inc., New York.

Standard Battery Manufacturing Co., Fort Worth, Texas, reports a daily output of more than 100 batteries with the plant facilities increased for a production of 200. There are 50 men employed. The company started in 1918 with two men on the payroll and an output of two batteries a day. In 1921 the business transacted amounted to $260,000 and this year is expected to reach $375,000. Four years ago the company had less than a dozen selling agents. It now has approximately 400 in a dozen states and old Mexico.

Dickinson Cord Tire Corp. has entered the field with a cord tire machine perfected by F. S. Dickinson, veteran in the industry. Every cord is laid by a machine, the cords then being laid in strip units, comprised of several separate cords. Each strip is so graduated as to compensate for the variable circumference between the bead and the crown of the casing, so that the full area is covered. These strips are laid in the path representing the shortest distance between the two beads.

C. A. Shaler Co. patents covering solid fuel vulcanizers have again been upheld by Judge Page in the United States District Court, Minnesota district, in a suit brought against Loren Risk and others, doing business as Risk's Riskless Vulcanizer Co. These patents have been in litigation for several years in various districts, there being at one time, it is stated, as many as thirty-five infringements on the market.

Bearing Service Co. has opened its second branch in Canada at Winnipeg, Man., using this point to cover the western section of the dominion. W. L. Spain, formerly associated with the Chevrolet Motor Co. as its district manager, is in charge. The company maintains a branch at Toronto but the growing use of motor vehicles in Canada has made western expansion necessary.

Detroit Seamless Steel Tubes Co. has established a branch sales office in the Canadian Pacific Building, New York City. H. C. Kensing, formerly manager of the steel tubing department of the Hungerford Brass & Copper Co. at the latter company's metropolitan branch, has been appointed district sales manager for the New York territory.

Isotta Motors, Inc., New York City, has been appointed the agent for the United States of the Isotta-Fraschini products. U. V. D'Annunzio is president of the company and Ede Paoli, associated for more than three years with the Fiat Co., is the commercial manager.

National Association of Farm Equipment Manufacturers has moved its offices from 72 West Adams Street, Chicago, to the Transportation Building, 608 South Dearborn Street, that city.

Urbana Tool & Die Co., Urbana, Ohio, has completed arrangements with W. C. Straub, manufacturer's agent, to represent it in the Cleveland district.

Disteel Wheel Corp. announces that its New York sales room and service station are now combined at 189 Academy Street, Long Island City.

Unemployed Engineers Are Aided by Bureau

NEW YORK, April 3—The Federated American Engineering Societies number among its activities a free employment bureau maintained at 29 West Thirty-ninth Street for the purpose of relieving unemployment among engineers. The organization includes the American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers, and twenty-seven other associations throughout the country, its aggregate membership being 50,000 professional engineers.

In 1920 the bureau placed 69 per cent of the 2300 applicants for employment, and last year positions were obtained for 71.5 per cent. Complete statement of the qualifications wished for are requested from employers while similar thoroughness is required from the applicant, who must be a member of an affiliated association. During the industrial depression the bureau carried on an intensive campaign in Greater New York and New Jersey. W. V. Brown is manager of the bureau.

FREIGHT RATES REDUCED

SAN FRANCISCO, April 3—Substantial reductions in transcontinental freight rates are announced by all the cross-continent lines having terminals here and in Oakland, on a number of articles, chief among which is automobiles. Reductions range from 10 to 30 per cent on automobiles from Chicago to the coast, the 30 per cent reduction being in force on cars sent here for trans-shipment to steamers for export.

SHOW STIMULATES SALES

YOUNGSTOWN, OHIO, March 31.—The Youngstown automobile show gave marked impetus to the sale of motor cars in this city. Actual sales at the show numbered 128 cars, of which only 36 were trade-ins. The value of the cars sold was $208,640. Dealers report an average of three or four sales a week since the show to prospects obtained at that time.

METAL MARKETS

So far there has been no buying of a sufficiently representative character to warrant the statement that the market for sheets is established at the higher asking prices which a number of independent producers proclaimed effective April 1. When Judge Gary made the statement the other day that the Corporation was disposed to follow the lead of the independents in an equitable upward revision of prices he took pains to make it plain that the independents must not merely secure publication of higher quotations in the newspapers but that they must actually book orders for representative tonnages at higher prices before they can lay claim to a market leadership that will inspire others to follow.

In the course of the next few weeks it should become apparent whether the momentum of demand has become sufficiently strong to overcome the resistance which many consumers offer at this time to higher prices or whether these higher prices will slowly vanish amid the apathy of buyers. Whether the contention of steel producers that the prices which have prevailed so far were inadequate and in some instances below cost is correct or not, will have precious little to do with settling the fate of the new prices. Validity of the latter will depend solely upon the demand over the next few months. If this demand should turn out to be sufficient to support the higher prices, it is highly improbable that the movement will stop there. Quite a few steel consuming industries which have been out of the market for some time are resuming purchases on a modest scale and the greater diversity of the demand will be magnified and resorted to as a handy prop for ascending prices.

In many quarters developments during the last few weeks have created an impression that the advent of the year's second quarter marks the end of one phase of the post-war deflation movement and that the steel market is merely leading in the natural reaction that has now begun to set in and which those who hold this view believe will eventually spread to other commodity markets. Attempts to lift the steel market to higher levels have not been confined to sheets; automotive consumers of hot-rolled strip steel who a few weeks ago had no trouble in covering their requirements at 1.75¢ are now being asked 1.90¢, base Pittsburgh level.

Pig Iron.—Automotive foundries are buying foundry and malleable in a routine way. Sellers contend that the trend is upward but admit that the immediate future may bring a temporary halt in buying.

Steel.—Higher asking prices have become general for nearly all steel products but no transactions worthy of note have so far been consummated at these higher levels. Steel bars came in for impressive demand at the 1.40¢ price level; no business at 1.50¢ has been done so far. The last actual business in sheet bars for which up to $31. Pittsburgh, is now asked was at a fraction better than $29. Bolt and nut prices are stiffening.

Aluminum.—The market is fairly active with 17.50¢ seemingly the inside quotation for 98 to 99 per cent pure virgin ingots. Importers and dealers have their ears to the ground for advance news regarding the fate of aluminum in the tariff bill, but consumers are apparently not disposed to stock up even though they believe that the rate of duty will be raised considerably.

Copper.—Semi-speculative holders are taking on additional tonnages when price warrants.

Calendar

SHOWS

April 3-16—New York, Second Annual Electric Automobile Show, Showroom of the New York Edison Co.

FOREIGN SHOWS

March 10-July 31—Tokio, Japan, Peace Exhibition.

April 16-23—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czecho-Slovakia, Fourteenth International Automobile Exhibit.

May — Shanghai. Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15 — The Hague. Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.

May 6-21—Scheveningen, Automobile Show.

May 24-June 5—Barcelona, Spain, Automobile Show under Dealers' Direction.

May. 28-June 5—Prague, Motor Show. Hotel de Ville.

July 1-24—London (Olympia). Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Associação Automobilista Brazileria.

Sept. 15-20—The Hague. Automobile Show.

September—Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

Oct. 12-23—London (Olympia). International Commercial Vehicle Exhibition.

November — London (Olympia). Automobile Show.

Nov. 10-Dec. 19 — Brussels. Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia). Cycle and Motorcycle Show. British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

CONVENTIONS

April 20-22—Buffalo, N. Y., Sixth Annual Convention of the American Gear Manufacturers Association.

May 8-10—New York, National Association of Manufacturers.

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

May 12—New York, Annual Meeting, National Highway Traffic Association, at the Automobile Club of America.

May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.

May 22-25—New York, Palisades Interstate Park, Second National Conference on State Parks, Bear Mountain Inn.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28 - Sept. 2 — Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, April 28, May 26.

June 20-24 — White Sulphur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.

Willys-Overland Co. Takes 1921 Losses

NEW YORK, April 6—The Willys-Overland Co. is another of those in the automotive field which has taken its losses and is now in a position to go ahead on a profit-making basis. Its business, which has been excellent for several months, still is moving upward.

Net Loss was $8,633,279

A detailed report for the year 1921 shows a deficit of $23,560,389, after inventory adjustment, interest, depreciation and other charges. Its net loss after all expenses was $8,633,279, as compared with earnings of $8,822,152 in 1920. To this loss has been added $1,742,653 for interest; $2,130,169 for depreciation, etc.; $733,922 for tool replacement and $10,320,364 for other adjustments. This compares with a total deficit of $5,480,-394 for 1920.

It is explained that in computing the net loss, all expenses, including reduction in price of cars, idle plant expenses, adjustment of inventory values and other extraordinary expenses, have been included. It also is explained that the other adjustments mentioned include $7,412,-275 for reduction in value of investments in affiliated companies, $759,468 for additional losses on commitments and $2,-148,621 for reduction in value of tools, dies, jigs and patterns.

Inventories Reduced

The statement of assets shows that inventories stand at $17,696,814 as compared with $35,309,825 on Dec. 31, 1921. Other current assets are: Accounts receivable $1,545,505; notes receivable $806,221; cash $5,128,403.

The two largest items of current liabilities are notes and bills payable amounting to $18,479,625 and accounts payable amounting to $2,770,262. Arrangements have been practically completed for taking care of the bank loans which approximate $16,000,000. With these obligations deducted, the company could pay all its current obligations with the cash on hand and still have a balance.

G. M. STOCK ENHANCED

NEW YORK, April 6—The rapid advance in the price of common stock of the General Motors Corp. on the stock exchange added $51,376,475 to the book value of the stock outstanding from the close of business last Tuesday to the close of business last night. The holdings of the duPont interests increased in value in this period $18,750,000. Their holdings amount to 7,500,000 shares.

GEAR MAKERS TO MEET

BUFFALO, April 6—The annual meeting of the American Gear Manufacturers Association will be held at the Lafayette Hotel, here, April 20, 21 and 22. The program will give special emphasis to business conditions in the gear industry and the outlook for the immediate future. Reports will be made by committees on standardization.

GRUBB, VICTOR SALES HEAD

SPRINGFIELD, OHIO, April 5—H. A. Grubb, formerly with the Star Rubber Co., Akron, was to-day appointed general sales manager of the Victor Rubber Co., succeeding C. A. Swinehart who resigned. Grubb takes charge at once. Swinehart has been sales head of the Victor company for many years.

MONITOR MOTORS SUED

COLUMBUS, April 5—Suit to collect $29,051 has been filed against the Monitor Motor Co. and Ernest W. Pavey, receiver of the company, by Herschell-Spillman Co. of North Tonawanda, N. Y. The petition alleges that the defendant failed to keep a contract entered into for 1000 engines. In all only 42 engines were accepted.

Coal Strike Affects Motor Vehicle Sales

ALLENTOWN, PA., April 5—This city, on the outskirts of the anthracite coal region, is beginning to feel the effects of the strike, and reports in automotive circles indicate that curtailment of business is much more drastic in trade centers actually in the coal zone.

Here in Allentown, buying of cars and trucks for immediate delivery has slowed up considerably. Dealers are slowed up in making sales and most of the orders, while accompanied by deposits in the regular way, are for delivery "when the strike ends."

Reports of New Gasoline Methods Boost Stocks

NEW YORK, April 6—Sharp advances in the quotations on the stocks of two companies have followed reports in the last few days that they have evolved processes for lowering the cost of operating motor vehicles. One of these corporations is the Davison Chemical Co., which, it is reported, soon will announce a new method of extracting gasoline from crude oil. The other is the Barnsdall Corp., which is reported to have perfected a new fuel for gasoline engines to be called "super gas" and which will sell for 7 cents or 8 cents a gallon.

Committees representing the Society of Automotive Engineers and the National Automobile Chamber of Commerce are reported to have been impressed with the new Greenstreet cracking process for extracting gas from crude oil.

FORD ASSEMBLING AT CHICAGO

CHICAGO, April 3—The Ford assembly plant here started at capacity production of 240 cars a day April 1. A. W. L. Gilpin, sales manager, announces that the number of cars turned out under the 5-day week will be slightly over the average.